Established 1916 as
THE OIL WEEKLY

WORLD OIL

Canadian Issue

SPECIALIZED FOR EXPLORATION, DRILLING,
PRODUCING OPERATIONS AND MANAGEMENT

DECEMBER, 1954

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WORLD OIL

Established 1916 as The OIL WEEKLY

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a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☐ those you want to read first.

CURRENT OUTLOOK ARTICLES

☐ **U. S. storage capacity** is more than two barrels of oil for each barrel of actual inventory. This high ratio of capacity to inventory is essential in order to maintain a normal flexibility of operations. How much crude oil storage capacity is available and how much crude actually is in storage are questions answered in a recent report of the National Petroleum Council's committee on storage capacity. The report also reveals storage capacity and actual storage of clean products and of residual fuel oil. Turn to **Page 63. U. S. Storage Capacity Twice Current Inventory. L. J. Logan**

☐ **Lighten your burden** of the routine. Every executive has available to him three means by which he can do this. You can delegate. You can select.

Turn the Page ➧

THIS MONTH . . .

You can streamline. Turn to **Page 64** for some time-saving, money-saving hints on how to throw off detail. **You Can Shed the Detail Problem** . . . . . **Auren Uris**

☐ **Unitizing federal lands** for oil and gas exploration and development is explained in an article beginning on **Page 68.** Hundreds of thousands of acres have been leased by major oil companies and independent operators. This article contains suggestions which will enable operators interested in unitization comply with government regulations with the least possible delay. **How to Unitize Federal Lands . Edgar M. Pilkinton**

☐ **Another significant link** in the chain of Ellenburger discoveries in West Texas has resulted from the completion of Dora Roberts B-1 1 test for a 1417-barrel-a-day potential by Forest Oil Corporation and Cities Service Company. Turn to **Page 72** for a report on activities on the Dora Roberts ranch, the hottest play in the Permian Basin, together with engineering data on the well. **Dora Roberts Ranch Play Holds West Texas Spotlight** . . . . . **Anthony Gibbon**

EXPLORATION ARTICLES

☐ **What is the significance of deltas?** Are they sufficiently appreciated as reservoirs for oil accumulation? Beginning on **Page 95** is a two-part article discussing several clear-cut examples of deltaic reservoirs selected from the Mid-Continent area. Methods and application of the technique described in the article will assist subsurface men to a clear understanding of the significance of lenticular sands as important reservoirs for oil accumulation. **Deltas Significant in Subsurface Exploration** . . . . . **Daniel A. Busch**

☐ **Deeper drilling in Michigan** has resulted from the discovery of substantial oil production in the Richfield zone. The Richfield had never been considered important until Miami Operating Company completed a well which tested 372 barrels of sweet oil daily. But what are the zone's broader aspects? Current production practices? Potentialities? For this and other information on the Richfield zone, turn to **Page 100. Richfield Is a Major Oil Zone for Michigan** . . . . . **Gordon H. Hautau**

DRILLING ARTICLES

☐ **Lower drilling costs** can result from a planned, scientific approach to the crooked hole problem. Improvements are being made through the use of the Lubinski-Woods charts. But there are several cases where conditions are severe, making it necessary to drill with light weight. New techniques make it possible to eliminate experimenting in such costly formations. Check to find out where the hole will go off, how severe it will be, when the hole will be straightened, and what hole size must be drilled. Proper selection of drill collar size and placement of stabilizers and reamers greatly reduce the cost per foot. See **Page 129. Cut Drilling Costs With a Planned Crooked Hole Program** . . . **R. J. Bromell**

☐ **New horizons in offshore drilling** are promised by Kerr-McGee Oil Industries' newest submersible drilling barge. It's designed to drill to 16,000 feet in 40 feet of water. Costing $2 million, this self-contained unit promises to open for economic development a much larger area of the Continental Shelf. **Page 140. The Newest "Ship" in the Petroleum "Navy"** . . . **Anthony Gibbon**

☐ **A new exploratory tool** has been developed which measures the density and porosity of subsurface formations in place. It gives the geologist a new tool for correlating surface formations and will enable the production engineer to obtain valuable additional information for use in well completion decisions. How the new tool works and the results obtained so far are described in **New Logging Technique Measures Density and Porosity** . . . . . **Page 142**

☐ **Extension of bank credit** to drilling contractors requires specialized handling which is sometimes not understood by the contractor. Here's an article by an oil-country banker explaining the limiting factors and outlining the basis upon which the drilling contractor can obtain bank credit to carry on his business. Turn to **Page 149. How Drilling Contractors Can Satisfy the Banker** . . . . . **Earl L. Beard, Jr.**

☐ **Drilling problems in the Williston Basin** are being resolved rapidly. Supply centers strategically located have eliminated a major problem. With experience, drilling is beginning to settle itself to a routine based on current drilling techniques. For an up-to-date look at Williston Basin development read . . . **Contractors Are Solving Williston Basin Problems** . . . . **Page 152**

☐ **Air slips have paid off,** one major drilling company has found. They have proven advantageous from an operational standpoint as well as a safety measure. This company found that on at least two occasions fishing jobs have been avoided by use of this type slip. Turn to **Page 158** for an interesting discussion on the advantages and disadvantages of this tool. **Air Slips Cut Rotary Drilling Time** . . . . . **J. C. Kernan**

PRODUCTION ARTICLES

☐ **Increased income from secondary recovery projects** in the latter stages of operations can be realized by instituting some cost-saving ideas. Little items, though small in cost, add up over the years, and take a big chunk out of the operator's profits. In some operations, the salaries paid to employes are greater than the income from such projects. This situation can be offset by . . .

- Standardizing
- Watching inventories

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THIS MONTH . . .

- Purchasing in economical units
- Planning work
- Checking power consumption

For a discussion of these and other practical cost-cutting ideas, turn to **Page 173. How to Reduce Operating Costs in Secondary Recovery**.....**K. C. Cochran**

☐ **Multiple-stage casing cementing** now incorporates two and three-stage methods. Better equipment and improved techniques have accounted for increased application of this unique method. With tools currently available, multiple-stage cementing offers full depth cementing, cementing off formations at any point, reducing pump pressures and preventing loss of cement into thief formations. More data on the technique, a full explanation of the operation accompanied with diagrams and photos of equipment used are contained in an article starting on **Page 176. Multiple-Stage Casing Cementing Uses Two and Three-Stage Methods**...**Phil Montgomery**

☐ **Water-flooding of 26,000 acres** in the Burbank field is Oklahoma's largest secondary recovery project. Operators have recovered more than 4 million barrels of oil since the operation started four years ago. Ultimate recovery is expected to total 180 million barrels. For operational techniques and results of this mammoth flood, turn to **Page 182. Water-Flooding Revives Famous Burbank Field**.....**C. H. Riggs**

☐ **What causes subsurface corrosion** and how it can be controlled has become a field for the specialist. However, it is the field operator who has the responsibility of maintaining a good inhibitor program. In simplified terms, the mechanics of corrosion in oil wells and the function of the inhibitors in controlling subsurface corrosion are explained starting on **Page 191. How Inhibitors Work in Subsurface Corrosion**. **James D. Crawford and Thomas M. Newell**

☐ **Horizontal fractures** affect sweep efficiencies when water-flooding or gas cycling in thin reservoirs. Influence of such fractures has been investigated for the five-spot pattern by means of potentiometric models. Among resulting indications is the fact that fractures up to 50 feet in radius will cause only a small decrease on the sweep efficiency. For other results, see Part 4 of this series, **Page 197. Water-Flooding and Gas Cycling Affected by Horizontal Fractures in Thin Reservoirs**.....**Dr. Paul B. Crawford**

☐ **Emulsion problems caused by corrosion inhibitors** can be minimized by testing the chemical under operating conditions before putting it to use. Tide Water found that in some of its high-pressure gas condensate wells, several inhibitors causes serious emulsion problems. A simple device was made to test 37 chemicals in order to find one that caused little or no emulsion. See **Page 200** for operating and fabricating details. **Inhibitors Checked at the Wellhead**.....**D. R. Fincher**

Photo courtesy Imperial Oil Limited

CANADIAN CLIMBER. Imperial Oil geologist George Patterson chips samples from sheer face of a mountainside above Lake Kananskis in the Rockies southwest of Calgary. He came part way up by horse and remainder of distance on foot. Loose shale makes climb dangerous.

CANADIAN ARTICLES

☐ **It started with Leduc.** The discovery of Canada's Leduc oil field almost eight years ago marked the beginning of a great petroleum exploration and development program which has boosted the number of wells to 6000 and potential crude production to 375,000 barrels daily. For an economic assessment of the Canadian oil and gas industry, turn to **Page 60. Market Expansion Major Canadian Problem**.....**R. H. C. Harrison, Q. C.**

☐ **New discoveries and restricted crude outlets** characterize the 1954 Western Canadian oil industry picture. Turn to **Page 215** for the complete details on prairie provinces' exploration, drilling, production and pipe line activities. **A Cautious Optimism Prevails in Canada**.....**Gilbert M. Wilson**

☐ **Success has been the keynote** in the drilling programs instituted at Pembina oil field since its discovery although continuing rains throughout the summer hampered full-time development work. For a brief history and current data on what may become Canada's largest major oil area, read . . . **Pembina Field's Development Drilling Proves Successful**. **Page 222**

Turn the Page

THIS MONTH . . .

☐ **Exploration problems are great** in the 680,000 square miles of the Mackenzie River Basin. But air photos and aircraft are easing two of the major obstacles. For the cost of a geological party's operation in the area and other details about the expanding exploration there, turn to **Page 228. Exploration Is Picking Up in the Mackenzie River Basin**.....**Arthur B. Irwin**

☐ **A Canadian record** for one rig in one field has been set by Old Rig 17. Since spudding in the first of the 64 wells, it has drilled 341,000 feet or 64½ miles in the Leduc field. **Rig 17 Has Drilled 64 Miles and 64 Wells**.....**Page 236**

☐ **Cardium sand exploration** and correlation work throws light on potentialities of Pembina, called Canada's most significant oil exploration venture since the Devonian limestone reef discovery at Leduc in 1947. Turn to **Page 238** for a discussion of Cardium occurrence and why understanding it may lead to discovery of similar occurrences in other Cretaceous horizons. **Cardium Correlation Sheds Light on Pembina Potential, Dr. J. C. Sproule**

☐ **Smiley field** has become an important light crude reserve. Turn to **Page 252** for a brief summary of how wells are completed and how drilling problems in this Saskatchewan field are being solved. **Smiley Becomes Important Light Crude Reserve. A. D. Hunt and M. K. Taylor**

NEXT MONTH . . .

Air and Gas Drilling

An all inclusive study of techniques has been compiled. Some of the questions to be answered include:

- **In what areas will air and gas drilling be practiced?**
- **What type of compressor equipment is available?**
- **What are the hazards of air and gas mixtures?**
- **Can water zones be conquered?**
- **What are the advantages?**
- **What new equipment will be used?**

Watch for this special feature in the Drilling Section of your January WORLD OIL.

•

What's Ahead in '55?

The industry enters the new year under the shadow of some weighty problems. Some, like inventories and the flaw in the Natural Gas Act, are obvious. Others are less apparent but nevertheless important.

What are these problems and how shall we solve them?

We have put this question to some of the best minds in the industry. Their answers will be waiting for you in the January issue.

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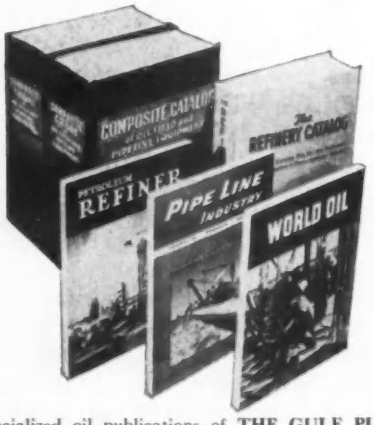
All of this plus the regular Current Outlook, Production and International features will be available to you in January.

Start the New Year off right with your January issue of WORLD OIL



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PETROLEUM REFINER and **THE REFINERY CATALOG** for the refining-natural gasoline-petrochemical industry.
PIPE LINE INDUSTRY for the oil and gas pipe line industry.

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Indexed by Industrial Arts Index and Engineering Index

Looking Ahead . . .

. . . **Higher operating levels are likely** for the U. S. oil industry in 1955. John Boatwright, Standard Oil Company (Indiana), says a normal winter would result in a 4.3 percent growth in demand next year compared with less than 2 percent in 1954. He sees this as requiring refinery runs to be 282,000 barrels per day higher, and the production of 262,000 barrels per day more crude.

. . . **Surplus producing and refining capacity** in the U. S. is not going to stop exploration and drilling, nor refinery construction. Competition will maintain the search for new oil fields. Likewise, competition will require that many refiners build new facilities so they will not be at a cost and quality disadvantage.

. . . **A definite business upturn in the first quarter of 1955** is expected throughout the U. S., according to a recent Dun & Bradstreet, Inc., survey. Of 1309 of the nation's business executives, 56 percent expect higher sales, 43 percent are looking forward to larger net profits after taxes, 79 percent think they will operate with the same number of employes, and 14 percent believe they will add employes.

. . . **There is continuing optimism** that, before long, both Argentina and Brazil will revamp current restrictive petroleum exploration and development laws to attract foreign investment capital and technical know-how in an effort to increase domestic crude output and to improve their dollar position.

. . . **Increased demand for natural gas,** fuel oil, gasoline, asphalt and lubricating oils are indicated by the record construction anticipated for 1955. Labor and Commerce Departments jointly estimated that new construction will reach an all-time high of $39.5 billion in 1955—or 7 percent above the record $37 billion estimated for 1954.

. . . **A sizable increase in footage drilled**—and a significant decrease in the number of rigs in operation—is forecast for 1955. A. W. Thompson, president, A. W. Thompson, Inc., expects 1954 footage of about 207 million feet to be boosted next year to approximately 217 million feet. Too, it is expected that 50 to 100 fewer rigs will be used to drill 1954's footage since the trend is toward deeper wells.

. . . **A four percent improvement in U. S. economy in 1955** is expected by Lionel D. Edie and Company, New York. That rise, equal to $14 billion in gross national product, will put GNP up to $370 billion without allowance for price changes. In dollar terms, consumers are expected to expand total spending on goods and services by approximately $9 billion. A potential gross national product in ten years of between $540-$560 billion in today's prices also has been calculated.

. . . **An astounding growth in transportation has been predicted** by Richard L. Bowditch, Chamber of Commerce board chairman, Washington. He foresees railroads carrying 800 billion ton-miles with diesel engines handling more than 95 percent of rail traffic, pipe lines moving 300 billion ton-miles, automobiles accounting for 600 billion passenger-miles of travel with up to as many as 65 million units on the highway.

. . . **The free world will need 600,000 barrels of new crude production** each year for the next four years. This 5 percent demand increase was predicted by G. M. Knebel, exploration manager of Standard Oil Company (N. J.). Industry must invest $11 billion in the same period to find, produce, and distribute this quantity of oil, he said.

. . . **The federal government says demand will dictate future leasing activity** in the federal lands in offshore areas. Thus, no large-scale periodic offering of leases for oil prospecting will be held.

SLURRY OIL SQUEEZE

New DOWELL SERVICE is designed to control water production in oil and gas wells

SOS* (Slurry Oil Squeeze) is a new Dowell cementing service designed to stop undesirable water production quickly. It has proven highly effective in both oil and gas wells in almost every type of formation.

The slurry used in SOS consists of portland cement, a special Dowell surface tension reducing agent, and a non-aqueous carrying medium like diesel oil or kerosene. The cement will not set up in the presence of the non-aqueous carrying medium or the crude oil contacted in the pay. It will readily set up when contacted by formation water.

The entire batch of SOS slurry is pre-mixed in truck-mounted, paddle-mixing tanks. This method provides a smooth oil-cement slurry of any density the operator desires. Then high-pressure, triplex pumps are used to inject the slurry into the formation.

Here's proof that SOS pays off! Dowell engineers were called when a well tested several hundred barrels of salt water daily, with only a trace of oil. After SOS, the well produced 40 BOPD and no water. Another well was producing 30 BOPD and 30 BWPD. An SOS treatment stopped all water production. The well still made 30 BOPD.

For full information on Slurry Oil Squeeze call your nearest Dowell office or write DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. L-13.

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Opportunity Knocks

A critical problem of rising exploration and development costs faces the oil industry of the United States. This is particularly true in offshore operations, where development is just now getting into high gear.

Last month the oil industry bid $23 million for leases on federal lands lying 10½ miles off the coast of Texas. The previous month the industry spent $130 million for federal lands off the Louisiana coast. An additional $78 million has been spent for leases on offshore lands belonging to the states of Louisiana and Texas.

However, this is just the beginning of expenditures.

Operators who have purchased offshore leases now are faced with the necessity of spending additional large sums for exploratory and development drilling. The cost will be terriffic. Wildcats in the area will cost several times as much as land wells.

Large quantities of oil and gas are expected to be discovered in this offshore area. Nevertheless, unless the industry uses every means at its command—technological and economical—to reduce expenses profits will shrink rapidly.

•

One opportunity to reduce costs is through the adoption of unitization. Although offshore tracts will in general be larger than those on land, fields and structure are sure to extend over lease boundaries. This will result in diversified ownership, causing offset drilling. Even though wider spacing will be used, unitization offers many possibilities for reducing the number of wells drilled. Unitization would eliminate the necessity of drilling wells solely for the purpose of validating each individual lease rather than drilling on the basis of structural conditions. The present situation permits lease ownership and offset wells to dictate the location of drilling sites rather than giving a free hand to drill according to the best geological and engineering information. The latter would save large sums of money and recover more oil.

In addition to savings in development costs, unitization offers other benefits. Unitization would make it possible to operate a field as a single unit. Pressure maintenance and other beneficial producing techniques could be adopted more easily. More oil would be recovered.

•

Never before has the industry had such a wonderful opportunity to adopt unitization. Instead of having to deal with a multitude of land and royalty owners, there is only one—either the state or federal government. Likewise, there would be fewer oil companies involved in each unitization program.

The state and federal government should not object to the companies wanting to reduce drilling costs. Their income will come from royalties on the oil produced, not from the wells drilled.

In the long run, the states and federal government would benefit from a program of unitization. Besides getting more royalties from higher production yields, the money saved on development would be used by the companies for testing other tracts.

No other action can give offshore development a bigger boost at this time than the widespread adoption of unitization. It is an opportunity that should not be lost. Now is the time for action to be taken.

Warren L. Baker

RIG DRILLING IN PEMBINA FIELD, about 75 miles southwest of Edmonton, Alberta. The field ultimately may be the largest in Canada. However, lack of roads and unseasonably wet weather this year has delayed its development.

Expansion of Markets Major Canadian Problem

Natural gas on brink of 'coming into its own' as a significant source of energy.

By R. H. C. HARRISON, Q.C.
President, Canadian Petroleum Association, Calgary

CANADA'S OIL INDUSTRY now is capable of producing almost 70 percent of the nation's estimated 1954 demand. In 1953 Canada could have produced 67 percent of its demand but only produced about 43 percent, due to other oil producing areas of the world selling competitively to potential Canadian markets on both the East and West coasts. It is expected Canada will produce only about 50 percent of the 1954 demand. Although this not sound like a substantial increase over 1953, it might be pointed out Canada's 1954 demand is expected to be 7 percent higher than that of 1953. In other words, it is estimated that 1954 production will be almost 22 percent greater than that of 1953.

Just over seven and a half years ago oil was discovered at Leduc, and that discovery was the beginning of the great exploration and development program of the Canadian oil industry. Therefore, in order to draw comparisons, depicting development, 1946 will be taken as the base year.

Western markets sought. Expansion of markets is a major problem facing the Canadian oil industry, but the industry is working diligently to solve the complex problem. The principal Canadian market not presently served with western crude is the marketing area served by refineries in and near Montreal, P. Q. Refining capacity of the Montreal area is approximately 180,000 barrels per day, which is about a third of Canada's total refining capacity. This market is supplied principally by South American crude delivered by tanker to Portland, Maine, and piped from there to Montreal, by the Montreal-Portland pipe line. Some adjustments in the various phases of crude oil marketing could provide an entry of this area for Western Canada crude.

Another potential outlet for Western crude is the Pacific Northwestern U. S., and in the not too distant future it is reasonable to consider export of Canadian crude to California. At present Alberta crude is providing a portion of the crude requirements of the General Petroleum Corporation refinery at Ferndale, Wash. The capacity of this refinery, when completed, will be 35,000 barrels per day. A further possible outlet in the same area will be a 50,000 barrels per day refinery being built by Shell Oil Company at Anacortes, Wash. However, in considering this area as a possible outlet for Canada's crude, it must be recognized that competition from other oil producing areas of the world, utilizing tanker transportation, may continue to put Canadian crude in a non-competitive position.

Partial Saskatchewan solution. Saskatchewan's crude oil marketing problem arises mainly from the fact that the majority of its crude is from medium to heavy gravity. This situation will be eased somewhat when the Socony-Vacuum Oil Company and associates' 155-mile pipe line from the Fosterton Field is connected to the Interprovincial Pipe Line at Regina. Socony and associates will move the oil to St. Paul, Minn., where

1946		Now
11	Geophysical Crews	185
19	Rigs	275
400	Wells	6,000
19,000 b/d	Potential Production	375,000 b/d
245,865 b/d	Refineries	576,200 b/d (End of 1954 estimate)
45,000,000	Reserves	2,044,000,000 (Dec. 31, 1953)

it will be refined in a specially designed refinery. It is indicated that Fosterton crude will be transported through the Interprovincial Pipe Line to Superior, Wis., and then another line will be built to St. Paul, Minn.

Canadian demand has been increasing at a steady rate since 1946, which, of course, provides larger markets for Canadian crude.

Since the discovery of Leduc, approximately $1.5 billion has been spent for exploration and development of Western Canada's oil industry. In 1946, $15 million was spent for this work. In 1954, it is expected that $400 million will be spent for exploration and development.

Refining capacity increased. In addition to this expenditure, about $750 million has been spent on refinery and pipe line construction and expansion. During 1953 total refinery capacity was increased by approximately 16 percent with the most significant change taking place in the British Columbia area. Increases scheduled for 1954 and 1955 will raise the nation's capacity to approximately 576,000 barrels daily.

Table 1 gives the average daily refining capacity in Canada.

Pipe lines now are playing a major part in transportation of crude oil and products. Table 2 shows mileages and capacities of these lines.

The pendulum depicting Canada's domestic-imported crude oil ratio has swung toward the Canadian side. This year, for the first time in history, domestic crude supplied more than half the Canadian refinery crude oil requirements. Also indicative of the importance and the growth of Canada's crude production is the fact that in 1953 the gross value of crude produced exceeded the gross value of any other single mineral produced in Canada. For that year, the gross value of crude oil amounted to $198,112,000, while nickel was in second position with $160,861,000. Copper with $150,631,000, gold with $139,826,000, and coal with $102,100,000 followed.

Natural Gas Outlets Loom. It now appears that Canada is facing an era when natural gas will come into its own as a major source of energy.

A permit granted to Trans Canada Pipe Lines Limited brought this $300 million project another step closer to reality. The pipe line, as planned, will feed the Toronto and Montreal areas and will have a connecting line running south from Winnipeg to the Minneapolis-St. Paul area of the U.S.

THIS IS MAIN STREET in a town in Drayton Valley. This small community finds itself in the heart of the drilling boom in Pembina area.

Before natural gas supplies of the magnitude required by the Trans Canada program can be termed available for delivery, a lot of money will have to be spent. Wells will have to be drilled to delineate and develop fields. Absorption plants will have to be built to strip out the wet products from the gas. Gathering lines will have to be laid within the fields, and lateral lines will have to be installed to bring the gas from the fields to the trunk grid system. In those areas where the gas is sour, additional facilities will have to be installed to remove the sulphur.

In all, industry estimates that it must invest between $100 and $150 million in wells, feeder lines and plants before it can deliver the gas into the start of the west-east pipe line. The gas gathering system in the

TABLE 1

	1946	1948	1950	1952	1953	1954–55
British Columbia	21,800	26,650	28,850	28,350	50,850	53,500
N. W. T.	840	1,100	1,250	1,250	1,250	1,250
Alberta	17,300	35,750	46,900	68,000	69,150	81,550
Saskatchewan	18,175	26,475	33,575	50,300	58,100	63,100
Manitoba	4,500	4,500	7,800	19,700	20,000	27,500
Ontario	77,950	88,700	75,200	104,500	135,000	135,000
Quebec	71,000	107,000	143,000	164,000	176,000	196,000
New Brunswick	300	300	300	300	300	300
Nova Scotia	34,000	25,000	22,000	22,000	18,000	18,000
Canada	245,865	315,475	358,875	458,400	528,570	576,200

(Source of Information: Dominion Bureau of Statistics, Industry Periodicals)

TABLE 2

Crude Trunk Lines	Mileage at End of 1953	Capacities, Barrels per Day	Areas Served
Interprovincial	1,754	165,000 Out of Edmonton	Alta., Sask., Man., Ontario and U.S.
Trans-Mountain	711	120,000 Out of Edmonton	British Columbia
Transit and Storage	151	46,000 Out of Cygnit, Ohio	Sarnia, Ontario
Portland-Montreal	236	149,000 Out of Portland, Maine	Montreal, Quebec
Trans-Northern*	442	40,000 Out of Montreal	Ottawa (branch line) Toronto, Hamilton
Sarnia Products*	188	39,000 Out of Sarnia	Hamilton, Toronto
Sun-Canadian*	200	17,500 Out of Sarnia	Toronto, London, Hamilton
Total	3,682	576,500	

* Product pipe lines.

Province of Alberta will be made up of approximately 1000 miles of trunk lines and laterals, and this does not include miles and miles of field gathering systems which will be required to gather the gas.

Petrochemical industries expanding. Petroleum and natural gas development has been one of the main driving forces which brought new industry to Western Canada, particularly the petrochemical industry which is so closely associated with the availability of natural gas. From the use of natural gas as a base material, Consolidated Mining and Smelting Company's plant at Calgary manufactures ammonia and ammonium nitrate fertilizers, with a world-wide market. Shell Oil and Royalite Oil produce sulphur from sour gas at Jumping Pound and Turner Valley. Both these plants produce 30 long tons of sulphur a day. Canadian Industries Limited has completed an explosive plant south of Calgary using ammonium compounds from natural gas.

Canadian Chemicals is completing a plant which started initial operations in June, 1953. The raw materials for its chemicals will be from natural gas and a high alpha wood pulp from an associated company at Prince Rupert. The company is making a number of organic chemicals, some of which have never before been produced in Canada. Among their products are cellulose acetate, acetate staple fibre, and filament yarn.

Canadian Industries Limited is completing a plant in Edmonton which will produce from natural gas about 6000 tons of polyethylene flake a year. This is eight times the amount presently available in Canada through import from the U. S. and the United Kingdom.

Sheritt-Gordon Mines Limited has now entered the petrochemical field at Fort Saskatchewan and produces ammonia from natural gas. This ammonia is used as a leaching agent for the recovery of nickel, copper and cobalt. Excess ammonia is used for the production of chemical fertilizers.

One of the best ways to judge the benefits derived from the growth of the industry is to take a look at the money received by the Province of Alberta. From royalties, bonuses, rentals, and other payments, the Province of Alberta has received more than $300 million since 1946—the equivalent of $300 for every man, woman and child in the province, or more than $900 for every taxpayer in the province.

Alberta, in effect, is a debt-free province. This province now has an outstanding debt of about $80 million, but on the other side of the ledger, it has investments totaling more than $120 million. These figures speak for themselves and indicate the improvement in the financial picture in a region where gas and oil are discovered and developed. The other prairie provinces do not, as yet, show such a marked improvement in public revenues. This is due in a large measure to the fact that comparatively little crude or natural gas has been produced so far in the other three western provinces.

Through initiative coupled with good luck, the petroleum and natural gas industry of Canada has enjoyed an unprecedented development during the past seven and a half years. The industry now is facing major problems of expanding existing crude oil markets and finding new markets for its crude, along with the big task of creating large markets for natural gas. To realize these ambitions, members of the industry will have to display ingenuity, resourcefulness and energy.

The industry itself is confident that much more oil and natural gas will be found in Western Canada and new markets eventually reached.

—**The End**

About the Author

R. H. C. HARRISON practiced law at Leduc and Edmonton before he enlisted in the RCAF in 1940. He returned to practice law in Edmonton following his retirement from the RCAF. Harrison joined the British American Oil Company as western counsel in 1946. He was later appointed western manager of crude oil purchasing; vice president of B. A. Alberta Pipe Line Company and Saskatchewan Pipe Line Company; and was appointed public relations officer of the company for the Prairie provinces.

In 1951 he resigned from British American to assume the presidency of the Western Canada Petroleum Association, now the Canadian Petroleum Association. The Canadian Petroleum Association is recognized as spokesman for the oil business in Canada. Its members produce or refine over 97 percent of Canada's crude production. The association has a paid administrative staff and a number of standing committees to deal with problems of the industry.

For more about Canada, see the International Section

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U. S. Storage Capacity Twice Current Inventory

National Petroleum Council Committee report finds large petroleum storage availability indicated as necessary to keep normal flexibility of operations.

By **L. J. LOGAN,** World Oil Staff

The petroleum industry of the U. S. currently holds 100 barrels of storage capacity for each 47 barrels of inventory, it was revealed in the recently issued report of the National Petroleum Council's committee on petroleum storage capacity (1954).

The most interesting finding of the committee, said L. S. Wescoat, chairman, is the very large petroleum storage capacity indicated as necessary to maintain normal flexibility of industry operations.

NPC first made a survey of storage capacity as of March 31, 1948, and then found an average of 100 barrels of capacity to every 41 barrels of inventories held in steel storage or reservoirs. A second survey, as of Oct. 31, 1950, showed 100 barrels capacity to 45 barrels of inventory. In 1952 the ratio was the same. In 1954 the data showed 47 barrels of inventory per 100 barrels of capacity.

In no sense can the difference between inventories and capacities be taken as an indication of available storage space, however, the committee warned. The industry must enjoy complete flexibility at all times if normal operation of its far-flung transportation, manufacturing and distribution systems is to prevail, and if supplies to consumers are to be delivered efficiently and on schedule.

Some of the significant facts revealed by the survey were cited in the report of the committee and are here recounted.

Crude Oil

1. Total capacity for storage of crude oil in tanks above ground in the U. S. amounted to 425 million barrels March 31, 1954, a slight decline from 1952. This includes almost 10 million barrels or reservoir storage in California, a decline in this type of 4 million barrels.

2. Total crude oil in tanks and all other facilities, including pipe lines, tankers, etc., but not producers' lease stocks, was 244 million barrels.

3. The amount in tanks alone was 195 million—thus indicating above ground storage to have been 46.7 percent full. In this connection it should be borne in mind that much of the reported tankage is in areas where it is not currently available for use, and some of it is not susceptible to relocation elsewhere because of its condition. Still other portions are available only for limited use.

4. Approximately 49 million barrels or about 19.2 percent of all reported crude, are constantly required as main trunk and tank farm pipe line fill (44.3 million), as well as average required fill for tankers, barges, tank cars, and trucks hauling crude (4.5 million).

5. More than 76 million barrels, not including line fill shown above, are required to assure continuous operation of pipe lines and as crude tank bottoms; while 41 million are required to assure continuous processing and the handling and blending of the many grades of crude oil produced in the U. S. and processed in its refineries.

6. The combined total of all unavailable stocks of crude which is the combination of 4 and 5 above, amounted to about 68 percent of all crude in storage March 31, 1954.

Clean Products. Companies that submitted figures for the survey had in their manufacturing, storage, and distribution systems about 251 million barrels of clean products, including gasoline, kerosine, and distillate fuel oil on March 31, 1954. That amount was 97 percent of all clean products of all companies in storage countrywide for that date, as reported to the Bureau of Mines. The returns revealed the following further details:

1. Total storage capacity assigned to clean products as of March 31, 1954, amounted to 467 million barrels, and that capacity contained 231 million barrels on that date, thus indicating assigned capacity to have been approximately 49.6 percent full on the date indicated.

2. Of the 251 million barrels of these products reported as in storage, 92 million barrels or about 36.5 percent of reported inventories were unavailable for shipment. Included in this figure are 12.7 million barrels required for pipe line fill and 7.2 million barrels average unavailable in transit by tanker, barge, tank car and truck. The balance of the total indicated unavailable is composed of amounts required as tank bottoms, unavailable unfinished amounts in refinery lines and operating equipment, pipe line operating requirements, etc.

3. The 467 million barrels of clean products storage capacity reported for March 31, 1954, is expected to increase to 496 million barrels by December 31, 1954.

Residual Fuel Oil. Companies that replied under this section of the survey held 96.5 percent of the residual fuel oil reported to the Bureau of Mines March 31, 1954. Information revealed by them showed the following facts:

1. They had a combined residual fuel oil storage capacity of 99 million barrels, including 50 million in California, of which 32 million were reservoir storage.

2. The above storage held 42 million barrels of product and was therefore 42.6 percent full.

3. Of total reported inventories, about 14.4 million barrels was unavailable for shipment to market because it had to be retained in order that residual operating facilities could continue to function.

4. Storage capacity assigned to residual as of Dec. 31, 1954, would total 106 million barrels, including 55 million in the Pacific Coast five state area, of which 36 million are to be in reservoir storage. —**The End**

You can . . .

Shed the Detail Problem!

You can . . .

- Delegate
- Select
- Streamline

By AUREN URIS, Research Institute of America, Inc., New York

IF YOU can't lick the problem of detail, it will most certainly lick you. Whether you stay on top of your job, or vice versa, depends largely on your handling of this problem.

Detail can be deadly because it sneaks up on you. A short time may be all it takes to see the change. One day, everything is under control. A week later, you're going down for the third time in an ocean of paper work, routine followup, and so on.

Every executive is familiar with the quick-breeding aspect of detail. Details cluster around the average executive desk like iron filings around a magnet. And it's human nature to try to overcome the difficulty by wading in with phone and pen flying. For this reason, the chances are good that as of this moment, a considerable amount of routine could be removed from your shoulders. Not only would there be no loss as a result, but the increased time you could allot to more important matters would undoubtedly show up in better carrying out of your primary responsibilities.

Your Triple Defense Against Detail—

Every executive has available to him three means by which he can lighten the burden of routine. These should be applied in the following sequence:

. . . I. Delegate
. . . II. Select
. . . III. Streamline

I. DELEGATE

Delegation is an important executive technique. Putting it even more strongly: the executive who *fails* to use delegation is probably executing not his job, but himself.

As a farmer, wading through a patch of Canadian thistle said, "It ain't all hay." Neither is delegation.

Delegation can cause trouble if the *wrong* duties are handed over:

- Over-all control. No matter how extensive are the delegations you undertake, responsibility for final performance must rest on your shoulders.

- Responsibility for operating policies. You may call upon others to contribute, but you cannot expect anyone else to take the consequences in case of kickback.

- The hot potato. Don't make the mistake of passing one down the line just to take yourself off the spot.

On the other hand, the matters you *can* delegate are fairly recognizable.

Check up on the time you spend now—

. . . filling out routine reports, requisitions, etc., that could be handled by a clerk, secretary or other subordinate;

. . . making calculations and entries that a clerk or other subordinate is fully capable of doing;

. . . making routine checks—on inventory, for example—or other static situations which are basically a matter of ascertaining easily identifiable facts;

. . . running your own errands—which might be better turned over to a messenger boy or other subordinate;

. . . engaging repeatedly in certain simple mechanical tasks.

If you can reduce any of these to a matter of a final okay, a signature, or the dispatch of a messenger, they are probably suitable subjects for delegation.

More on Drawing the Line—

At some point, however, you may have to go easy on delegation. It's best to hang on to a chore, for example, if—

- It's too technical. Computing a cost or calculating production capacity may be simple for you, but completely beyond the capacities of a subordinate.

- The duties involve a trust or confidence. In some instances, for example, personnel files or records, cost data, or other highly confidential matter may be involved.

You may find that under certain circumstances it is possible to delegate duties involving initiative, judgment and decision. You may be on firm ground, but you have to consider these factors carefully:

The nature of the duty to be delegated;

The ability of the person whom you are considering to take over the job;

Your ability to keep control—that is, to keep posted on how well he carries out the job, and how quickly you can come to his rescue if he gets into trouble.

The time element is often an important factor. It sometimes helps to determine whether you can or can't delegate. Problems that don't have to be solved by a given deadline are worthwhile subjects for delegation. The top executive who's having a tough job with a customer may turn over that specific customer-relations problem to a subordinate for consideration and suggested solutions.

You can save yourself the wear and tear of detail work by using the delegation device if—

. . . you make a point of knowing just what your subordinates' abilities are;

. . . you make full use of the collective abilities of the people in your department; (Sometimes no single individual may be able to take over, but a two-man team might provide a perfect solution.)

. . . you avoid taking up new problems or undertaking new procedures yourself without first asking: "Is

this something that could be better done by one of my staff?"

II. SELECT

An office manager recently passed the word along to the head of his automatic addressing machine department: "Check your #3 machine for a broken selector pin."

The supervisor did as directed. To his astonishment, he found that the pin on that machine actually was snapped off short.

There was no witchcraft involved. A sound executive procedure made it possible for the manager to put his finger on the trouble spot.

Frederick A. Taylor, father of scientific management, referred to the method as the "Exception Principle." It's a method of control by checking the *deviations*, the *exceptional* cases.

The bit of magic performed by the office manager had a logical explanation. He had received complaints through his customer relations department about non-delivery of addressed material. All the complaints had come from one area. Since he knew the machine that handled the addressing operation for that area, he reasoned it was that machine that was at fault. A broken selector pin seemed the most likely explanation.

Basically, the Exception Principle boils down to, "Check when things go wrong." But to get the best results from the method, it must be systematized.

Keep in mind that it can't be applied to every type of work. Some authorities recommend using "Control by Exception" only if:

- The exception doesn't turn up too late, that is, if remedial steps will still be inexpensive.

- You can set up a standard. To recognize an exception, you must be sure what "normal" activity is. In one company, for example, the executive set up a maximum of 5 percent rejects as "normal." If sub-standard material went above this figure, the matter called for immediate investigation.

- You can get a report of results. You must be able to arrange to have a subordinate inform you of irregularities. This way, your time isn't wasted in the unnecessary routine of checking everything.

III. STREAMLINE

"Reports, reports, and more reports. Reports are making me snow-blind!"

You've undoubtedly heard one of the most common complaints made by executives with the detail problem: "Routine reports are the big time consumer."

For your own amazement, you might like to list all the reports that pass through your hands—either outgoing or incoming. Here's a sample list suggested by one executive:

Daily production record
Weekly production records
Monthly production records
Purchasing requisitions
Purchasing records
Payroll information
Subordinates' operating problems
Subordinates' written suggestions
Cost estimates
Progress reports
Development reports
Sales figures
Inventory reports
Operating cost figures
Special information

In your case that may be only a fraction of the report avalanche.

Anything you can do, therefore, to simplify the forms that pass over your desk—in either direction—is bound to cut down the load.

Of course, when forms originate with other executives, you may be limited to passing along your suggestions for simplification. But in most cases, they'll be receptive. They may have as much to gain as you do.

Here's a brief checklist of standard methods used to streamline report forms. You may want to run through them quickly to see whether any can be used to advantage in the reports you handle.

☐ **Both sides?** It's often practical to use both sides of a card or sheet, thus reducing the size of the form by half. A two-sided form generally requires a heavier paper stock to avoid show-through.

☐ **Standard information?** Fill-in material that has to be entered repeatedly can sometimes be made part of the form itself. Check: department names or numbers, codes, symbols, etc.

☐ **Punching?** A spindle file, or binder may be the best way for you to file a given form or record. Prepunching of the form by machine makes this method of filing easier.

☐ **Scoring?** Perforation makes it possible to retain the essential part of a form, and discard the balance. Where two forms have to be kept together, only *temporarily*, scoring makes it possible to send each on its respective way.

☐ **Check-mark entries?** Where the information required is a simple choice—Yes or No, for example, or Accepted or Rejected—it's easier to place check marks in a box than to write answers.

☐ **Vertical or horizontal?** Some information is better running up and down on a form, rather than reading from left to right. Addition and subtraction are easier if the figures are vertical. But entries that may have to be read after a form is filed will fare better running horizontally across the top of the form.

Up-to-Date?—

A periodic review of your executive workload is the surest way to keep the detail problem under control. Don't take it for granted that because you licked the job yesterday, you're rid of the problem today, or if you don't have the problem now, it won't be strangling you tomorrow.

And here's a final important point. Keep in mind that the detail that bogs you down can be a valuable ingredient of someone else's job. You can use routine duties as a means of training subordinates, preparing them for expanded duties, providing a testing laboratory for ideas and ingenuity.

—The End

A purchasing agent tells . . .

'Salesmen I Favor and Why'

Listen in on a sales call that "sold" him and find out why.

By JOE A. HUITT, Manager Purchasing,
Deep Rock Oil Corporation, Tulsa

JACK IS ONE of my favorite salesmen, and I'll admit he has a good chance of increasing his sales to my company. To see why I favor Jack, I'd like for you to "listen" to one of his recent sales calls.

Jack walked into my office wearing his usual big smile and said, "I'm glad you had time to see me today, Joe, because I have some pictures here that I'm sure you'll find interesting. They were taken on one of your leases near Bristow."

While making these preliminary remarks, Jack shook my hand, walked around to the side of my desk, and laid two photographs and two drawings in front of me.

Already Jack has pointed out three of the reasons for his success. First, he is busy and knows buyers are too—his first sentence acknowledged this. Second, he comes immediately to the point of his visit without being curt or unfriendly. Third, he captures the buyer's interest with useful sales aids —in this case photographs and drawings that are directly related to the subject of his call.

By these tactics Jack succeeded in a few seconds in arousing my interest and in getting my complete attention. Look at what he did next to capitalize on this good beginning.

"Here, Joe, are two pictures of installations on your Zee lease, and here are two drawings of units my company proposes to build for you for the same service. You will note in comparing these, that there are two major differences, here and here," pointing to the drawings.

In about five minutes Jack explained the significance of these two major differences. He showed me how one advantage would make maintenance easier and thus cheaper. To support his statement he went over some figures on labor-saving which he had calculated before coming to my office.

Take a look at this second phase of Jack's sales talk. He immediately told me what he wanted to sell me, and why I should want to buy it. Why is it that many salesmen either take considerable time to get to this point, or never get there at all? But Jack did, and then he demonstrated what I would gain, where the product would be useful to me, and how it compared to my existing equipment. From this point he launched into the close of his talk. Let's listen to it.

"Joe, I'd like to leave these pictures and drawings with you and also this quotation. You'll note here that I have broken down the quotation so you can determine prices for less than complete units. You may find this breakdown useful in checking our prices against other units you may have in mind. My quick calculations indicate good payout several places in your operations for these units. I know you may want to check your field men, possibly your engineers, and perhaps competitive units before committing yourself. Why don't you let me call you again—say, a week from today—to see if you need any other information?"

I agreed.

"In the meantime, if I can be of any help, just call me," Jack said. With a short farewell he was gone.

Now look at what Jack did in the last part of his call. First, he recognized that buying major equipment is generally the combined efforts of several departments in a company, and that a purchasing agent usually does not originate orders. This factor, so obvious to purchasing men, evidently is not obvious to many salesmen. For example, many times I've had salesmen wind up their presentations by asking, "How many X products do you want to order today?" Apparently, such men just don't know how most industrial purchasing is conducted.

But Jack recognized that, if I considered his proposition worthwhile, I might need to discuss it with operating and engineering people in my company before an order could be written. (Of course this is not always the case, since some items are bought regularly against standing requisitions.)

Jack recognized that other parties might be concerned, so he gave me the information I needed to verify the desirability of his product. His quotation made it easy for me to compare his unit with competitors' products. By supplying drawings, photographs and savings calculations, he made it easy for me to compare the advantages of his equipment with units we were already using. Then he determined when he should call next, offered his assistance in the meantime and left.

His closing words were geared to stimulate me to act within a reasonable but definite time. Jack's call lasted less than 15 minutes, yet it covered a complete sales presentation of above average complexity. Was Jack successful? Certainly. Within two

weeks he had an order for three units.

What can other salesmen learn from Jack's call? As I analyze Jack's call, I can see that the procedure Jack used is common to most top-notch salesmen that call on me.

- He was friendly.
- He assumed that he was calling on a busy man.
- He captured my interest.
- He got down to business quickly.
- He showed me why his message was important to my company.
- He gave me the information I needed to take further action.
- He obtained my promise to act.
- When he was through with his sales presentation, he left.

Note, too, that he was prepared for every phase of his sales talk. This is exceedingly important in saving his time and mine and in "jelling" the sale for him quicker.

Some salesmen reading this may say, "Sure, that's fine for a guy that has a big story to tell, but how about me? My job is just to keep in close contact with purchasing men and many times I don't have much to offer; I'm just making a 'routine call.'"

Some salesmen—and especially those making routine calls—seem to feel that purchasing men prefer to talk about themselves and their personal lives. But most of the purchasing men I know would rather discuss ways of saving company dollars than ways of saving strokes on the golf course. I believe that salesmen on "routine calls" underestimate their true worth. As I see it, there are two basic aids that any salesman can continually offer a buyer. They are latest information about his product and the probable importance of this information to the buying company.

Included in the first are such things as current prices and deliveries and impending shortages, as well as the way the product is used. My point is this: there is always useful information a salesman can give the buyer. But to do so usually involves some "digging" by the salesman.

Here's an example that serves to show how one salesman handled what many would consider routine price information:

Early one afternoon Bill came into my office and said, *"Joe, we believe there is going to be a 10 percent price increase on Product A within the next few days. It's expected this will be an industry-wide increase. I checked your last three months' purchases from us of Product A, and I figure that the expected increase on an equal volume would cost you this much."* Bill put before me a sheet showing the calculations.

"You're normally stocking about a 60-day supply, aren't you?"

I agreed.

"In 60 days you normally buy about this many units. Since we can delay shipment for as long as 45 days, you can safely order units now and schedule delivery so you never exceed your 60-day inventory."

"Now Joe, you probably buy only part of your requirements from us, but my figures give you some idea of what you can save by ordering now before the increase goes through."

"Why don't you let me call you later when I get back to my office—say about 4:30? By then, you may have decided how much Product A you want to get on order at today's prices."

I agreed to have the information by 4:30, and Bill left.

Take another look at Bill's more or less "garden-variety" type of call. You notice that Bill was prepared to quote benefits to me just as Jack had. He recognized that additional people might have to be consulted (competitors, too). He knew about what our operations called for and what his company's experience with mine had been. He had the authority from his company to make a firm offer, and he had closed his call by stimulating me to act, setting his next time to contact me. In all this you will note he acted on a routine matter in much the same way that Jack did—brief and to the point.

Too frequently the salesman who can't show ways that his company can serve ours ends up begging for business. This type of selling is seldom very fruitful.

Mr. H. is the "begger" type. He calls regularly. About every other call, I take time to see him, and it's the same story each time.

"Joe, why don't we get more business from you? We've got a lot of stock over there, good material. We used to do a lot more business with you. We'd like to see that happen again. Are you mad at us?"

Mr. R. has a similar story, but he is a little threatening at times. He says, "Joe, looks like there might be a shortage soon on Product W. You need plenty of W to keep operating. We want you to have a good buying history on all of our products you use. That way we can take care of you when things are short. I hear you're in the market for 50 Product B's. Don't you think you better send a big part of that order to us?"

I'm sure that many purchasing men and salesmen recognize this tactic. Does the salesman really expect to generate good relations with such an approach? Remember, other salesmen with the same opportunity to threaten, don't threaten. Instead, during periods of shortages they keep right on selling in the Jack and Bill manner—continuing to serve their customers, continuing to merit their business. In competition is it any wonder that Bill and Jack do so much better than Mr. R. and Mr. H.?

Summing up the weaknesses we have noted in some salesmen, we see that many men take too long to present their story, they waste their own and the buyer's time in excessive small talk. *They take too long to get to the point.* Few come prepared to show how their product will benefit the buyer's company. Many lack the enthusiasm to stimulate the buyer to act for them. Then, lacking the ability to sell by positive means, many resort to begging or veiled threats.

I fully realize that buyers are often far from capable; however, this just increases the need for the salesman to know his job. The shortcomings we have observed here are costly to the salesman because they keep him from successfully competing with dynamic and useful salesmen like Jack and Bill, who are bound to find open doors and receptive minds wherever they call. —**The End**

How to Unitize Federal Lands

Here's a step-by-step outline that will help interested operators comply with all government rules with the least possible delay.

By EDGAR M. PILKINTON, Assistant to the Chief, Conservation Division, U. S. Geological Survey, Washington, D. C.

UNITIZATION OF federal lands for oil and gas exploration and development offers operators many advantages:

• A company or individual may not hold in excess of 15,360 acres of federal lands in leases are applications for leases and 100,000 acres in options in any one state at any one time. If a company or individual commits federal lands to an approved unit agreement, such land is exempt from acreage charge, and an equivalent amount of acreage then may be acquired so as to bring federal land holdings to the full limit.

• Unitized operations afford more efficient and economical use of good engineering and conservation practices. This means elimination of unnecessary competitive drilling, greater control of formation pressures, less dissipation of reservoir energies, institution of secondary recovery programs, and, ultimately maximum economic recovery.

• Leases effectively committed to unit agreements are extended beyond their primary terms by unit production even without leasehold production. However, extension of federal leases under unit agreements hinges on effective commitment of the lease record interest.

The following step-by-step procedures must be followed to complete a unit in wildcat or semi-wildcat areas. In proved or partially developed areas, appropriate modifications may be necessary to suit the particular conditions. However, operators should also consult the appropriate oil and gas supervisor for current and specific details whenever such information is needed.

The Secretary of the Interior has delegated authority to the director of the Geological Survey to approve most unit agreements involving federal lands. However, the secretary still must approve forms of unit agreements containing unusual conditions or drastic departures from forms heretofore approved by the secretary. There are very few forms of this type proposed, as usually they are needed only for developed areas. More time is required in that process because there are then more members of the department who must review and endorse such a form or agreement before the secretary will approve it.

The title "director" has confused some people, especially since both the Survey and the Bureau of Land Management have a different director. Appropriate care and distinction should be exercised in filing unitization papers with the proper bureau.

The steps:

• Apply for the designation of an area regarded as logical for unit operation and development.

Such an application, in triplicate, and as complete as possible, should be addressed to the Director of the Survey and filed with the appropriate regional Oil and Gas Supervisor. It should identify objective formation, indicate depth of proposed test well, and include all available geological, geophysical and other pertinent data indicating the presence of structural traps favorable for the accumulation of oil and gas and which may be helpful to the Geological Survey in designating an area considered logically subject to unitization.

Scientific data are regarded as confidential. A few applications for designations have been received which did not conform to the geology or to the information presented. They either had to be returned for additional information and revision or be rejected. Such delays may be avoided by being sure the proposed area conforms to data presented.

• After the application is reviewed in the Supervisor's office, it goes to Washington with the supervisor's recommendation. If the application is acceptable, the director will designate the area requested. But, if necessary, he may prescribe certain changes. He may accept the proposed test-well depth or require a different depth.

• When the director's designation is received, the operator is ready to prepare his unit agreement and obtain signatures thereto if he intends to use the standard form.

• Whenever appropriate, the survey encourages use of standard form suggested in unit plan regulations approved December 22, 1950, (C.F.R. 30 Part 226). Copies may be obtained upon request from the director or from any regional Oil and Gas Supervisor. Use of the standard form saves time for the operator and government.

• If conditions require use of a form that differs from the standard, three copies of the proposed form with all deviations from the standard or previously approved guide form, plainly marked and complete with exhibits A and B, should be submitted through the supervisor for preliminary approval by the director. Unless proposed changes are so drastic as to require secretarial approval, preliminary approval will come from the director. If conditions require preliminary approval of a form, two to six weeks additional time may be required, depending upon the import of proposed changes.

If conditions warrant use of a specific nonstandard form previously approved, request for authority to use such form could be included in the request for designation in order to facilitate handling.

• For some states, the department has authorized the use of certain

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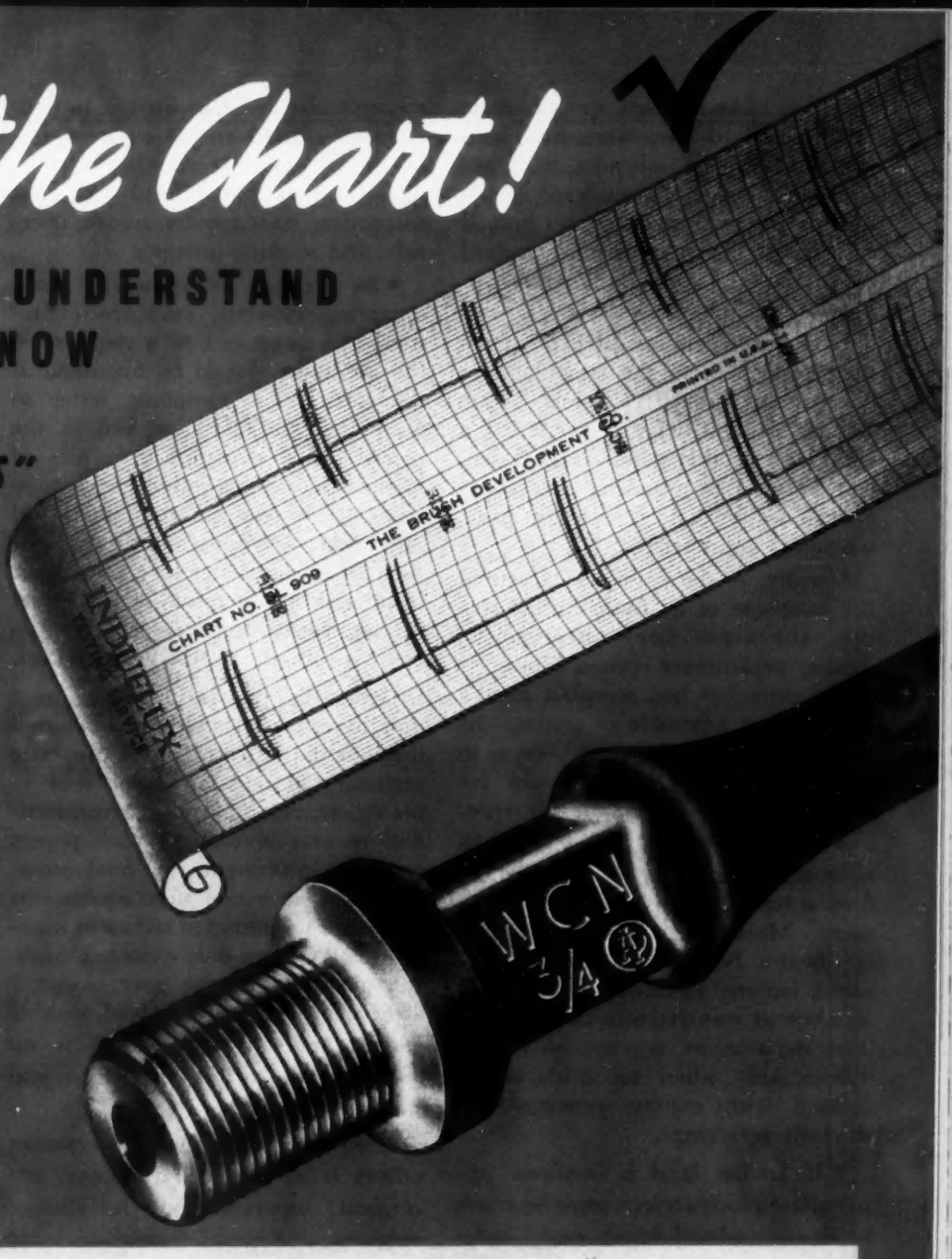

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language to be inserted appropriately in the standard form when state land is included in the unit area. Such approved language is considered standard for the appropriate states and, if such language is used in the standard form, the director's preliminary approval is still not necessary.

It is convenient to have all pertinent references to the state land in one section, usually titled "State Lands." It also helps in preparing a form, as a printed standard form then can be used by inserting the "State Land" section on a separate page, whenever appropriate.

Usually, if the state has accepted the language of a "State Land" section, the state does not require further preliminary review. However, if the state has not accepted such a section, it is advisable to contact the proper state officials in advance as to requirements it deems necessary for the protection of the state's interest.

• When state land is involved, the operator should get state approval before submitting the executed agreement. Most states attach approval certificates. Some feel it necessary to use a lengthy certificate including a number of conditions to approval. The department accepts such conditions only when no conflicts are created with express provisions of the unit agreement.

• If Indian land is involved, appropriate modifications must be made in the standard form and, under present procedures, preliminary approval must be obtained for all forms involving such land. Instead of three marked copies as previously mentioned, six must be filed with the supervisor who in turn will furnish three copies to the superintendent of the appropriate Indian agency.

• If both Indian and federal lands are involved, dual, final approval of the executed unit agreement is necessary and approval as to Indian lands must be obtained from the Indian Office prior to the director's approval. If Indian and no federal lands are involved, final approval must come from the Indian Office after appropriate survey recommendations.

• When the operator uses the standard form, or an approved nonstandard form, every owner of interest in substances to be unitized within the unit area must be invited to join, no matter how small or how important the interest may be. Usually, such interests are divided into four categories: basic royalty, record, override, and working interests.

• In the case of owners of nonoperating interests, evidence of refusal to join or lack of a response to the invitation should be furnished in the form of a composite letter so results of the invitation are in the record. Such evidence as copies of letters are not required, except in cases of oil and gas companies and other bona fide operators. In event of such refusals, a letter or copy thereof from such party must be furnished, stating reasons for non-joinder, especially if refusals involve federal leases.

Ordinarily papers pertaining to a unit agreement should be submitted through the office of the appropriate regional Oil and Gas Supervisor so his report, comments and recommendations may accompany such papers reaching Washington for final attention. The executed unit agreements should be submitted in sufficient number to allow four duly executed duplicate originals for the government if no Indian land is involved, five if Indian and no federal land is involved, and six if both Indian and federal lands are involved.

Normal distribution to government offices is as follows: director, the original; supervisor and his district engineer, one each; Bureau of Land Management office holding the lease records, one; Commissioner of Indian Affairs and appropriate Indian superintendent, one each; the BLM or Indian office being omitted whenever federal or Indian land, respectively, are omitted.

Accordingly, a number in excess of that required for government offices must be submitted to fit an operator's needs. If state lands are involved, the state probably will want a copy. But that matter is between the operator and state officials.

In conformance with the Comptroller General's order of June 16, 1950, (C.G. 29-576), the director must have an original; so care must be exercised to assemble one complete original (ribbon copy in all respects if typed). The number of related papers submitted for subsequent approval should conform to the foregoing procedure so each office or person holding a unit agreement will receive a complete record of subsequent actions.

• In units involving more than one committed working interest owner, three true copies of the unit operating agreement should be submitted, together with the executed unit agreement so commitment status may be correctly determined, as joinder to the unit agreement by a working interest owner without joinder to the apposite unit operating agreement may becloud the commitment status, causing unnecessary delays in processing unit agreement for final approval.

• Execution by corporate officers of unit agreements, or related paper requiring formal execution, should include the corporate seal and the proper attestation. Execution by agents, attorneys-in-fact, or parties of similar status, should be accompanied by evidence of authority to sign. Once such evidence is furnished, reference thereto will be sufficient for future exercise of such authority during the life thereof. This also applies to heirs and administrators.

• Each unit agreement must have two exhibits, customarily called exhibits A and B, as a part of each duplicate original. Sample exhibits are shown in the unit plan regulations brochure.

Exhibit A is merely a plat or small map showing the ownership of lands within the unit.

Exhibit B is nothing more than the same information in greater detail in the form of a tabulation, showing in a series of columns by tract numbers the description of land tracts by leases, number of acres, lessor, lessee, override owner, and working-interest owner.

If the ownerships are divided, percentages in each category should be shown in every instance. Such terms as et ux., et vir., and et al., should be avoided unless accompanied by definite names. Federal lessees are called the record owners, or lessees of record. That means the party in whose name the lease is recorded by the Bureau of Land Management.

Federal leases should be listed in the numerical sequence of their serial

Continued on Page 77

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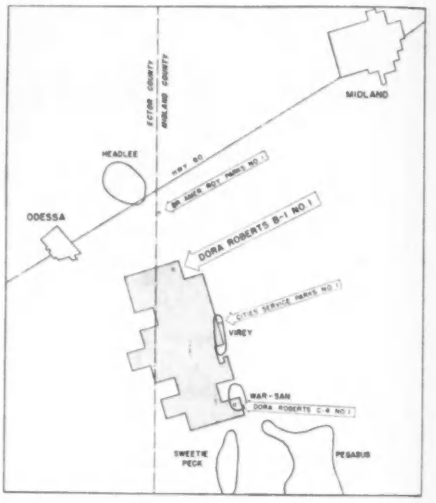
October 28, 1954.

DORA ROBERTS RANCH B-1 1, shown flowing into pits (left), was drilled by Forest Oil Corporation and Cities Service Oil Company. It extended Ellenburger production on the Dora Roberts Ranch nine miles. Inspecting the flow are, left to right, S. B. Irelan, president, Cities Service, Bartlesville; Burl S. Watson, New York City, president, Cities Service Company, New York, and D. D. Bodie, Hobbs, N. M., division superintendent for Cities Service.



SHADED AREA on map shows the 15,000-acre lease on the Dora Roberts Ranch, major Ellenburger reserve, owned jointly by Forest Oil Corporation and Cities Service Oil Co. Arrows point to the oil discoveries which prove the area.

Dora Roberts Ranch Play Holds W. Texas Spotlight

Forest Oil Corporation-Cities Service Oil Company well forges significant link in chain of Ellenburger discoveries in Ector and Midland counties.

By ANTHONY GIBBON, World Oil Staff

Completion in early October by Forest Oil Corporation and Cities Service Oil Company of the Dora Roberts B-1—1 test for a potential of 1417 barrels of oil daily has forged another significant link in the chain of Ellenburger discoveries that extends almost 14 miles southeastward from the Headlee field of Ector County and across the east side of the nine-mile long Dora Roberts Ranch of Midland County, Texas.

Development of this major West Texas basin reserve is necessarily slow because of the depth of the wells which top the Ellenburger at 13,000+ feet. As of Nov. 1, Forest and Cities Service had completed seven producers and no dry holes had been drilled. A new crop of producers is expected about the first of the year as tools keep busy at new locations.

The acreage in the Dora Roberts Ranch held by Forest and Cities Service lies midway between Odessa and Midland and extends approximately nine miles along the trend between the 185-million barrel Pegasus field to the southeast and the Headlee field to the northwest. (See map).

The first Ellenburger discovery on the Dora Roberts Ranch was the Forest-Cities Service Dora Roberts C-4—1 which was completed last summer in open hole from 13,070-233 feet and acidized with 22,000 gallons of acid. The well flowed at a rate of 3170 barrels of oil per day through a one-inch choke with 625 pounds tubing pressure on potential test.

The area attracted considerable attention when Warren Oil Corporation and Reynolds Mining Company reportedly paid a bonus of $5 million for leases in the area while the big ranch was being "shot."

In late 1953 Warren completed Sanders 2 in Pennsylvanian sands to open the War-San field. Shortly afterwards, Reynolds had a Pennsylvania sand producer to open the Virey field. Both discoveries are adjacent to the east side of the Dora Roberts Ranch.

The first Ellenburger producer adjacent to the ranch was Warren's Wallin 1, completed for 671 barrels of oil daily.

Following the discovery at the Dora Roberts C-4—1, the next link in the chain was the Cities Service Parks 1 discovery, offsetting the Roberts Ranch and midway up its eastern boundary. This Ellenburger discovery was completed for an initial of 3320 barrels of oil daily.

Latest link in the discovery chain is in the northeastern corner of the Roberts Ranch, five miles northwest of the Cities Service Parks discovery

ENGINEERING DATA ON DORA ROBERTS C-4—1 ELLENBURGER DISCOVERY

BIT RECORD	Number	Size
	1	17½ in.
	13	12¼ in.
	26	8¾ in.
	79	6¾ in.
	9	Chert Bits
DRILL COLLARS USED	5	8 in.
	15	6 in.
	21	6 in.
	28	3½ in.

CASING PROGRAM	Size Liner	Depth	Cement Used (Sacks)
	13⅜"	285.67'	225
	9⅝"	4,857.70'	2030
	7⅝"	4,518.79'	850
	5½"	13,040.63'	500

MUD PROGRAM (Cost $13,849)	Fluid	Depth
	Fresh Water	0– 1,600'
	Saturated Salt Water	1,600– 4,875'
	Fresh Water	4,875– 9,178'
	Gel Mud	9,178–13,233'

WATER SUPPLY — Adequate from single well drilled to 210 feet

ROADS — 15 miles of pavement and 5 miles of graded caliche roads

SUPPLY CENTER — Odessa, Texas

FUEL USED — Natural gas, butane and diesel oil

and three miles south of the British-American Oil Producing Company's Roy Parks 1 discovery.

Structurally, the new Dora Roberts B-1—1 discovery is higher than any other Ellenburger test in the area. It is 172 feet higher than the highest well in the Virey field, five miles to the southeast, and 148 feet higher than the highest well in the Headlee field, four miles to the north. These comparisons are based on a corrected Ellenburger top for the Dora Roberts B-1—1 of 12,835 feet, computed from an electric log. The well made 354 barrels of oil in six hours from 12,835 to 13,012 feet—a penetration of 177 feet into an estimated 500 feet of Ellenburger pay.

Forest Oil Corporation is the operator in the joint venture with Cities Service on the lease which contains approximately 15,000 acres out of 31 sections in Southwest Midland County and Southeast Ector County, Texas.

The large areal extent of the block and its close proximity to supply and other facilities as well as good transportation makes this play very attractive to drilling contractors and supply companies.

The Dora Roberts C-4—1, which opened this large Ellenburger reserve, was drilled by the Llano Drilling Co. which reached the casing point of 13,070 feet in 108 days, not counting rig up time. Severe lost circulation occurred above the Clearfork at approximately 5985 feet and through the Spraberry section from 7790 to 8900 feet. Oil and gas were encountered in the Wolfcamp at approximately 9053 feet and high pressure gas and oil were found in the Bend formation at approximately 10,290 feet. It is probable that a number of the wells drilled will be dual completions in the Bend and Ellenburger.

ACKNOWLEDGMENT

Information contained in the above article furnished by Forest Oil Corporation, Cities Service Oil Company and Joe Salman, Oil Editor, Midland *Reporter-Telegram*.

—**The End**

Unitizing Federal Lands

Continued from Page 70

numbers. If there is more than one land office serial, such as Cheyenne and Wyoming, list each group in sequence by serial. Indian land leases should be listed in the numerical sequence of their contract numbers.

Leases of each type of land should be grouped, i.e., put all federal land together, all fee land together and so on, each group being subtotaled as to acreage and percentage of the unit area.

Tract numbers are applied in normal sequence to the tracts listed on exhibit B and the only significance for such numbers is the convenient reference and ease of identification of various tracts. Listing or numbering of tracts by geographic location should not be attempted. It becomes too cumbersome.

• In instances where substantial interests are not committed, in addition to exhibits A and B, there should be submitted three detached sheets and three extra plats showing the status of commitments, using symbols or colors on the plats so the location of noncommitted lands can be seen readily.

The supervisor will keep two sets and send the other to the director. The position of the committed or noncommitted lands is of much more importance than the percentage of commitment. Conceivably, one could have 90 percent of the lands fully committed but, with 10 percent out of the heart of the unit, one would still not have effective control. And control of unit operations by the unit operator is one of the most important points in justifying approval.

The three summary sheets should show such information, perhaps under three categories, i.e., fully committed, wholly noncommitted, and partially committed tracts, and each category should be subtotaled in the same manner as on exhibit B. As nearly as practical, consent sheets should show the tract numbers in pencil and be assembled in the same sequence as the tracts on exhibit B. Generally, describing the lands committed opposite signatures should be avoided in order to minimize need for reexecution for any errors in such descriptions.

—**The End**

Oil Is Key Support of Canada's Bright Future

The potential of Canada's domestic industry could carry Western Canada into new phases of economic development. This optimistic—but well supported—long-range view was expressed recently by Ole Berg, Jr., president of British American Oil Company, in an address before the American Petroleum Credit Association's annual conference held in Kansas City, Mo.

While there is currently a leveling-off in certain phases of Canada's oil industry, Berg described the nation's oil industry prospects as the brightest of any industry in Canada. While crude production increased this year, the president of this Canadian-operating company said, producers of Western Canada are meeting the tough problems of competition. Too, he added, they are making adjustments and long-range plans for what lies ahead.

Pointing out the need for taking a long-term look at production, Berg said that proven assets of $7 billion worth of reserves are bound to produce future revenues that will bring benefits to all Canada.

"In time it could make the prairie provinces rivals of the older, more industrialized eastern provinces," he said.

Berg also linked petroleum and natural gas, either in the form of energy or petrochemicals, as essential elements of Canada's development.

Turning to another topic which has been discussed more and more of late, Berg said the great majority of informed people in the U. S. and Canada believed that there was no immediate danger of replacement of oil by atomic energy.

"While the nuclear form of energy will give Canada prodigious potential and great flexibility in establishing new sources of energy, it cannot supplant petroleum," he said.

Discussing the importance of the long-term view, Berg said it has become clearer in the past year or so. "In the early years of Canada's oil industry it didn't seem so important, and the phenomenally rapid growth resulted in bursts of optimism by speculators, operators and citizens generally."

"But today," he said, "the early unrealistic golden dreams have been replaced by mature economic appraisal and constructive planning."

Citing economic measures to show the scope, vitality and effectiveness the oil industry possesses, Berg said "oil has completely changed the economic profile of the prairie provinces."

Oil, he said, has stirred the entire nation "with new wealth and a source of home-grown energy that nourishes factory, farm and home as they never have been before. In no field of Canadian industry are prospects brighter than those of the oil industry."

He Found Wisdom, Kept His Enthusiasm

A couple of months back a group of industry men selected at random received a set of questions from DAILY OIL NEWS, published by WORLD OIL and its sister magazines as a service to those at the annual API meetings.

One of the questions was this: "What benefit do YOU think the oil industry derives from the annual API conventions?"

One of the replies received was this: "Fraternization, standardization, inspiration and liquidation."

Had Bruce C. Clardy, Dallas independent, delivered this tongue-in-cheek sparkler a few weeks later, it would have seemed likely that the "inspiration" was in soberly sincere commemoration of the words of Wallace E. Pratt upon receiving the API Gold Medal, highest accolade our industry can bestow.

Here, indeed, are words of inspiration, even when lifted from the rich, warm setting of their utterance, stripped of tonal inflection, and regimented in ink on stark white paper. Here are words of humility and gratitude from a man who has acquired wisdom without losing enthusiasm—a feat roughly comparable to producing crude without depleting your reservoir.

With wisdom, he looked back: "Over all the remainder of my professional career the petroleum industry has paid me a generous compensation merely for doing that which, of all things, I liked most to do. Through the petroleum industry I was enabled long since to attain the goal Robert Frost set for himself in the lines:

" 'My object in living is to unite
My advocation with my vocation,
As my two eyes make one in sight.' "

With enthusiasm, he looked ahead: "So expansive have my ideas of the probable total volume of the earth's petroleum resources become that my colleagues now look on me as a wild enthusiast . . . My optimism runs counter to the prevailing opinion in the best-informed circles . . ."

No more appropriate words could have been chosen by the recipient of oil's highest honor, for they truly reflect the spirit of an industry that owes its birth and is betting its future on that self-same "wild enthusiasm."

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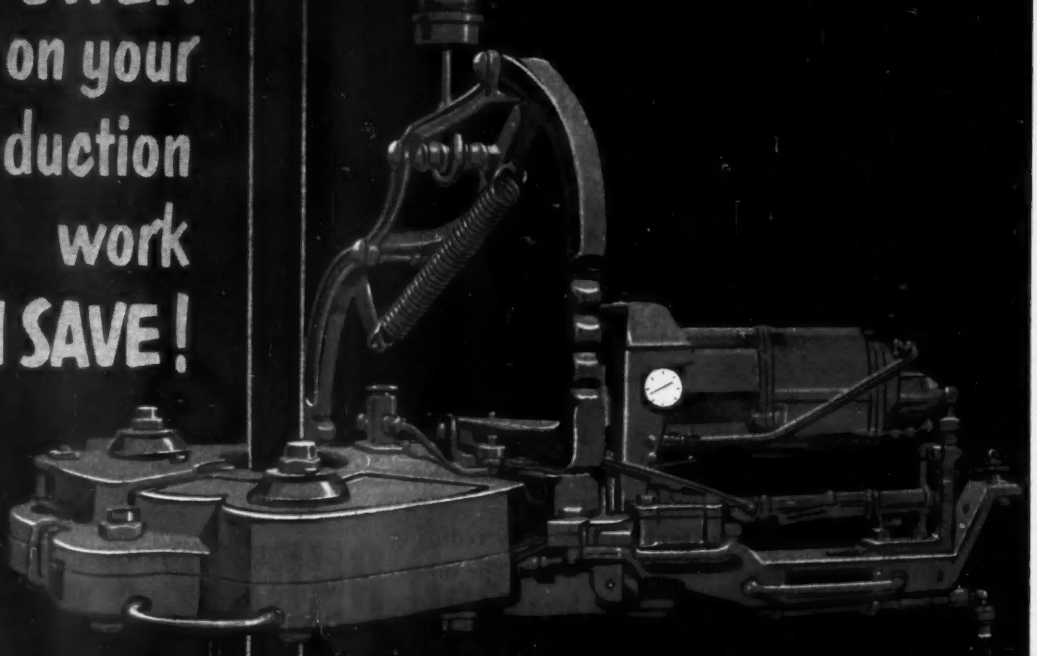

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By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Economic Outlook Greatly Improved

CONTINUED REDUCTIONS in gasoline inventories further improved the United States petroleum industry's economic outlook during the past month. The industry now is in its best shape of the year. Surplus motor fuel stocks are not nearly as serious a problem today as in preceding months. This places the industry in a position where continued proper regulation of refinery runs and product yields during the next four months will enable it to escape a glut of motor fuel next spring.

The improved outlook has been achieved by reducing refinery runs and reductions in gasoline yields. The downward adjustment of gasoline yields has been particularly noteworthy in recent weeks. During October refinery runs averaged 6,838,000 barrels daily in contrast with 6,960,000 barrels in September. Daily output of gasoline in October dropped to 3,343,000 barrels against 3,429,000 barrels in September, but distillate yields rose from 1,461,000 barrels in September to 1,516,000 in October.

•

IMMEDIATE PROSPECTS now depend largely upon the weather. A prolonged cold spell in the heating oil belt would do wonders for petroleum demand. Consumption of distillate fuels could jump more than 750,000 barrels per day. This would necessitate higher refinery runs, creating larger refinery demand for crude oil although intensifying the possibility of too much gasoline being made unless yields of motor fuel are held down. On the other hand, warm weather could have a very adverse influence on petroleum demand.

Distillate fuel stocks in the U. S. were only 1⅔ million barrels higher than a year ago in mid-November. Even a normally cold winter will require higher refinery runs than have existed in recent months, while an abnormally cold winter would necessitate a very substantial increase in refinery runs.

Crude oil stocks are in good condition. Enlarged refinery runs would immediately be reflected in higher producing allowables.

Stocks of crude totaled only 270½ million barrels in early November, 13 million less than a year ago and 15 million below the level at the end of June.

Prospects for higher refinery runs and the excellent level of crude stocks offer some relief to U. S. producers. For the second consecutive month, the permissible allowable in Texas has been increased. The allowable for December will be 128,000 barrels per day larger than in October.

•

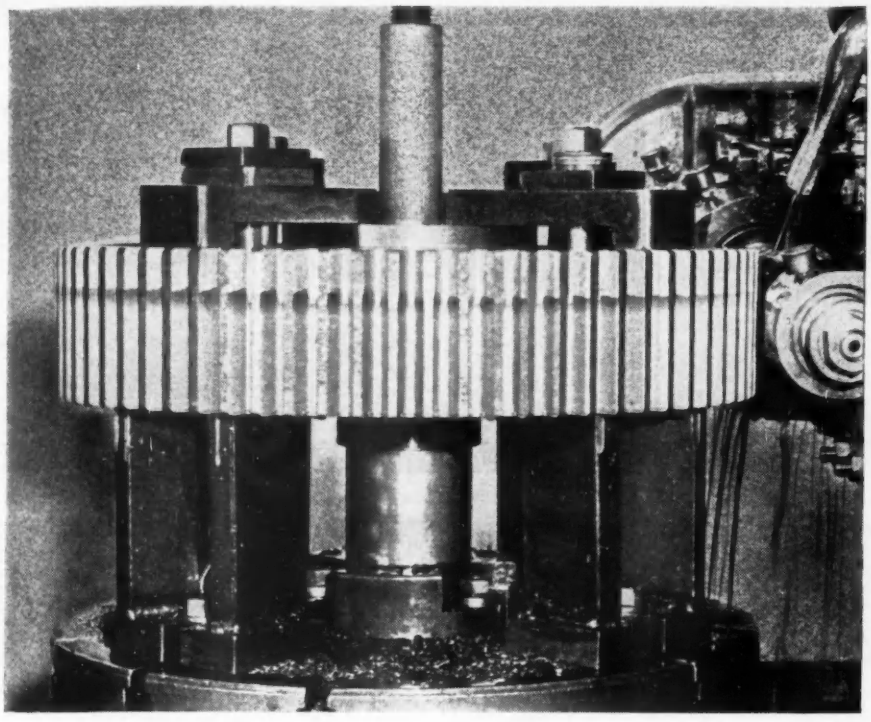
GASOLINE STOCKS in mid-November were only 5 million barrels larger than at the corresponding date in 1953. This represented vast improvement. A month previous they were 10⅓ million barrels higher than a year ago, although they had been 22 million barrels greater in mid-June.

Reduced refinery runs and a downward adjustment in gasoline yields combined to make this improvement possible. For example, gasoline yields in October were lower than in any other month this year, and nearly 100,000 barrels per day under year ago levels. Refiners were slow in regulating runs and yields to market needs, but they have done a masterful job during the past few months.

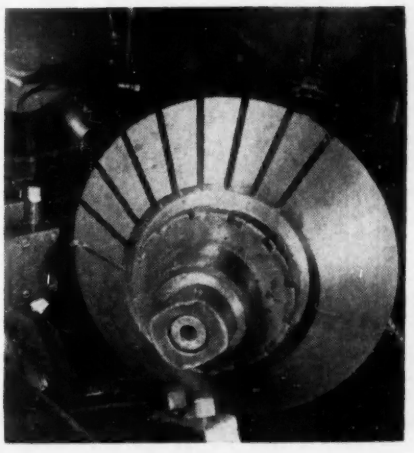
Highly significant during the past month was a notable improvement in the gasoline situation in the Indiana-Illinois-Kentucky territory. This area had been the chief sore spot in surplus gasoline inventories. A month ago motor fuel stocks in this region were 6 million barrels larger than in the previous year, but by mid-November inventories were only 3¼ million barrels higher than at the same time in 1953.

Reduction of surplus stocks in the Indiana-Illinois-Kentucky territory not only helps the local situation but improves the national outlook.

While there has been great improvement in the gasoline situation, refiners still need to continue operations at levels which reflect a more-than-usual seasonal shift from output of gasoline to output of distillates. If they do not continue this more-than-normal shift, the industry will have a shortage of distillate fuel and far too much motor fuel.



◀ Machining an axle gear at the plant of Goodman Manufacturing Co., Chicago. Widely known for its mining equipment, Goodman is a regular user of Bethlehem gear blanks.



▲ Many firms make strong bevel and miter gears from Bethlehem blanks.

How to make a STRONG Gear and still keep its weight down

Goodman shop craftsman tests a finished gear with master pinion.

Often the first problem in gear design is to achieve high strength with a minimum of weight. Bethlehem supplies an answer to this common problem with its forged-and-rolled gear blanks, which are available in sizes from 10 to 42 in. OD.

Forged-and-rolled means just what it says. The blanks are processed in a unique mill that combines the steps of forging and rolling, with the attendant benefits of both. Each blank has the density and compact internal structure of forged metal, plus the smooth grain flow of a rolled product. The end result is strength—high load-bearing strength. Thus users frequently find it possible to employ thinner, lighter sections than they formerly specified, and still meet every requirement.

Also, because of their good grain flow, uniform density, and clean, homogeneous metal, the blanks are very easy to machine. Cutting speeds are frequently higher, and finish-machining can often be accomplished with fewer cuts.

If you manufacture spur, bevel, miter, herringbone, or other types of gears, Bethlehem's forged-and-rolled blanks can lead to important economies. Please remember, too, that they are excellent for sheave wheels, industrial wheels, turbine rotors, clutch drums, tire molds, and numerous other circular steel products.

Many details—and almost 100 pictures—are to be found in Booklet 216, which is yours for the asking. Write today for a free copy, addressing request to Bethlehem Steel Company, Publications Dept., Room 1037-A.

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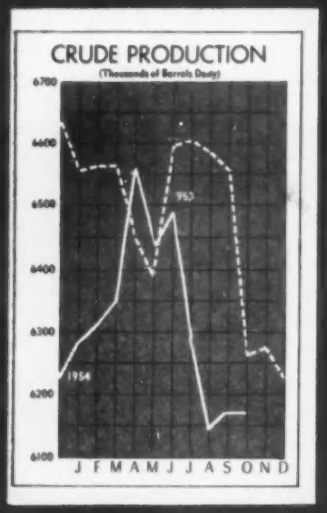
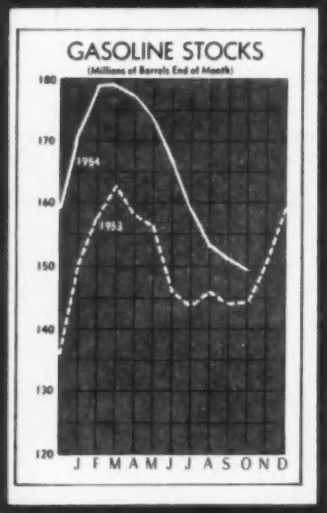
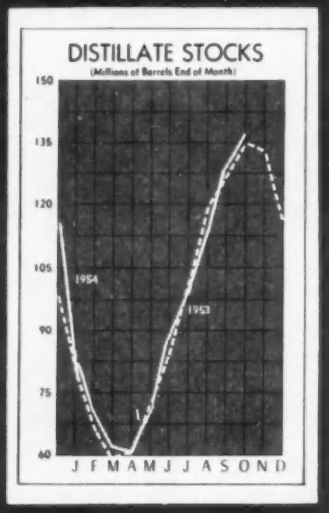
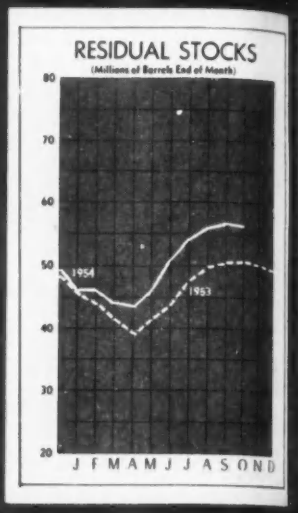
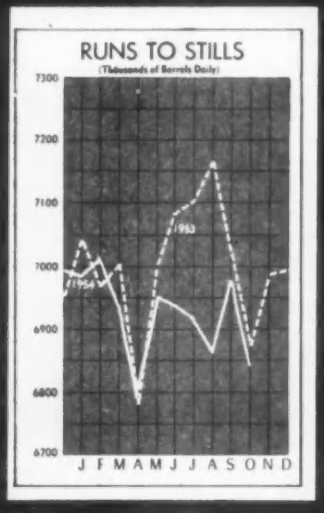
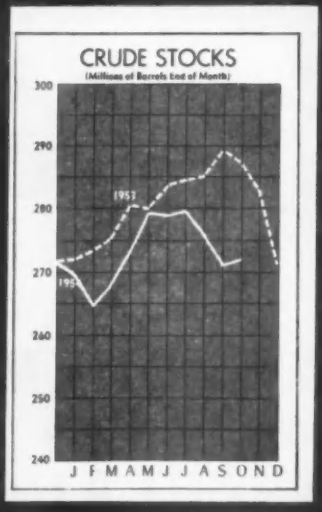












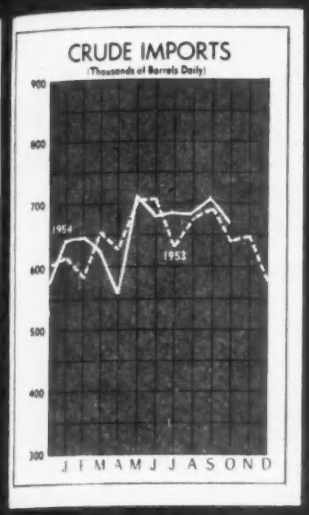
Petroleum Trends in U. S. . . .

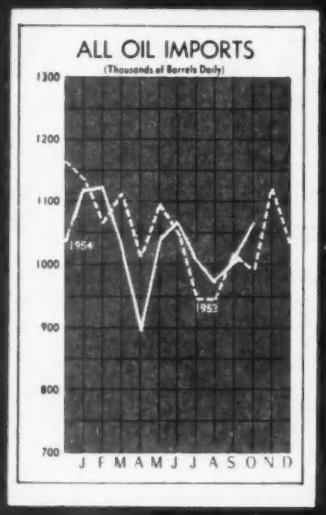
By CECIL W. SMITH, World Oil Staff

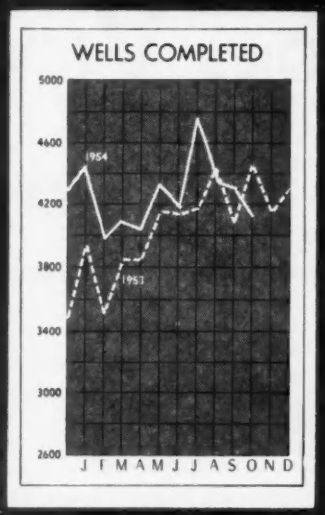
U. S. Crude Production by States

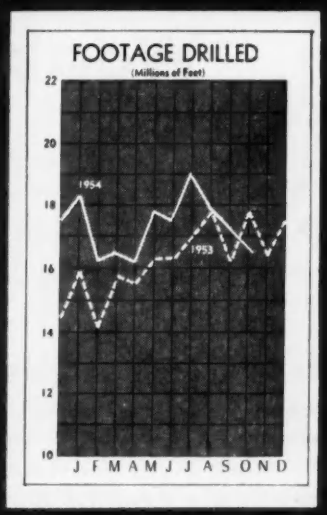
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION Oct., 1954	Sept., 1954	Oct., 1953	% Diff. Oct. '53-'54	TOTAL PRODUCTION First Ten Months 1954	1953	% Diff. '53-'54
Alabama	4.2	4.1	4.3	— 2.3	1,318	1,429	— 7.8
Arkansas	74.2	77.1	80.8	— 8.2	24,358	24,856	— 2.0
California	957.0	955.6	999.3	— 4.2	297,123	303,738	— 2.2
Colorado	135.8	131.0	91.2	+ 48.9	34,654	26,701	+ 29.8
Florida	1.5	1.6	1.3	+ 15.4	467	448	+ 4.2
Illinois	186.0	182.0	163.0	+ 14.1	54,525	48,645	+ 12.1
Indiana	28.3	27.8	34.8	— 18.7	9,276	10,988	— 15.6
Kansas	317.6	315.8	213.2	+ 49.0	99,058	96,828	+ 2.3
Kentucky	37.2	37.3	32.5	+ 14.5	11,302	9,585	+ 17.9
Louisiana	627.0	624.6	662.0	— 5.3	206,275	213,386	— 3.3
North Louisiana	106.2	108.8	110.7	— 4.1	34,212	34,777	— 1.6
South Louisiana	520.8	515.8	551.3	— 5.5	172,063	178,609	— 3.7
Michigan	31.9	31.6	33.5	— 4.8	10,019	10,240	— 25.4
Mississippi	94.1	93.8	93.1	+ 1.1	28,189	29,632	— 4.9
Missouri	0.1	0.1	0.1		58	20	+190.0
Montana	40.2	40.2	33.2	+ 21.1	11,229	9,581	+ 17.2
Nebraska	19.2	19.0	18.9	+ 1.6	5,934	5,085	+ 16.7
New Mexico	204.8	205.0	203.4	+ 0.7	61,898	58,473	+ 5.9
Southeast New Mexico	203.4	203.6	201.5	+ 0.9	61,322	57,865	+ 6.0
Northwest New Mexico	1.3	1.4	1.9	— 31.6	576	608	— 5.3
New York	11.3	11.4	9.9	+ 14.1	2,872	3,202	— 10.3
Nevada	0.1	0.2			5		
North Dakota	17.0	13.3	12.8	+ 32.8	4,420	4,301	+ 2.8
Ohio	10.7	9.7	10.3	+ 3.9	3,157	2,917	+ 8.2
Oklahoma	490.3	489.9	532.1	— 7.9	156,745	170,739	— 8.2
Pennsylvania	21.3	22.7	29.9	— 28.8	7,635	8,985	— 15.0
South Dakota	0.1	0.2			28		
Tennessee	0.1	0.1			13	10	+ 30.0
Texas	2,599.2	2,606.6	2,740.3	— 5.2	817,125	864,182	— 5.5
Dist. 1—South Central	42.8	42.3	39.1	+ 9.5	12,783	11,408	+ 12.0
Dist. 2—Middle Gulf	137.4	135.6	151.2	— 9.1	43,420	48,139	— 9.8
Dist. 3—Upper Gulf	420.3	424.4	459.5	— 8.5	133,477	144,429	— 7.6
Dist. 4—Lower Gulf-S.W.	231.6	230.7	260.0	— 10.9	74,173	79,962	— 7.2
Dist. 5—East Central	43.0	43.7	47.9	— 10.2	13,483	15,014	— 10.2
Dist. 6—Northeast	315.9	322.4	372.4	— 15.2	103,680	115,614	— 10.3
Dist. 7-B—North Central	133.8	133.6	117.9	+ 13.5	38,667	34,306	+ 12.7
Dist. 7-C—West Central	175.5	176.6	167.4	+ 4.8	54,799	50,666	+ 8.2
Dist. 8—West	823.7	831.8	864.3	— 4.7	258,730	277,266	— 6.7
Dist. 9—North	188.4	181.4	185.8	+ 1.4	56,747	55,430	+ 2.4
Dist. 10—Panhandle	86.8	84.1	75.4	+ 5.1	25,167	22,868	+ 10.1
Utah	5.4	5.2	4.7	+ 14.9	1,575	1,525	+ 3.3
Virginia	0.1	0.1			12	9	+ 33.3
West Virginia	7.9	7.9	9.3	— 15.1	2,457	2,459	— 0.1
Wyoming	247.0	256.4	247.6	— 0.3	77,658	70,341	+ 10.4
Total United States	6,169.6	6,170.3	6,261.5	— 1.5	1,929,385	1,978,305	— 2.5









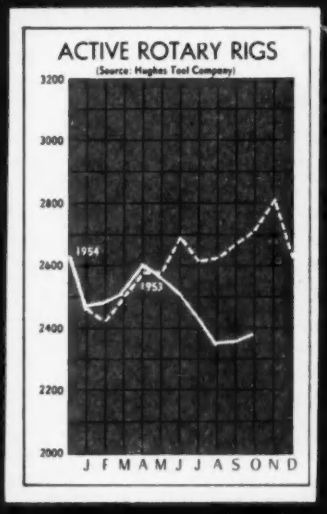
- Refining rate at six-month low
- Gasoline output lowest since 1952
- Reduction improves gasoline stocks

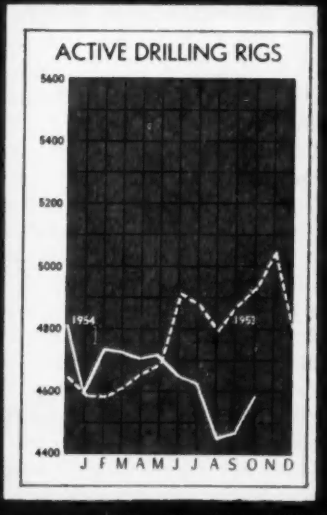
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:											
July	6,093	6,927	275,951	3,295	116,566	1,475	85,775	1,237	52,245	597	892
August	6,219	7,118	264,368	3,377	118,592	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	1,502	117,252	1,230	56,200	615	932
October	6,518	6,883	269,776	3,301	120,062	1,458	120,721	1,203	53,052	643	1,037
November	6,487	7,049	267,852	3,416	129,509	1,510	116,096	1,299	53,069	624	984
December	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January	6,555	7,042	272,250	3,384	150,518	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	1,505	67,167	1,275	44,178	586	1,066
March	6,531	7,002	275,665	3,319	162,731	1,489	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,282	158,032	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July	6,242	6,916	284,894	3,480	158,010	1,416	101,657	1,089	54,365	724	1,038
August	6,168	6,862	281,043	3,492	153,168	1,453	117,579	1,069	56,332	664	966
September	6,170	6,980	270,795	3,429	151,979	1,461	127,858	1,097	56,489	710	1,003
October	6,170	6,838	271,930	3,342	149,603	1,516	137,096	1,053	56,414	660	1,068
Oct. 1954 Change:											
In Month	.....	−142	+1,135	−87	−2,376	+55	+9,238	−44	−75	−50	+65
In Year	−92	−34	−15,611	−95	+5,108	+54	+1,687	−131	+5,594	+21	+78
Week Ended:											
11-12-54	6,220	6,883	267,049	3,452	147,896	1,630	136,159	1,121	56,068	623	1,036
11-13-53	6,219	6,951	284,932	3,421	142,836	1,422	134,532	1,180	51,194	775	1,290

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





WORLD OIL'S VIEWS OF THE NEWS

- Ranks closing for gas fight . . . • OWIU reloads its gun to win wage increase . . .
- Public views oil as 'nice monopoly' . . . • Texas ups allowable to hold markets . . .
- U. S. royalties up $7 million . . . • Industry wary of depletion allowance attack . . .

Gas Case Fight Nearing

Industry was grimly closing ranks last month for a now-or-never assault on the lethal octopus of federal gas regulation.

Superficially, there was cause for optimism that the Supreme Court's mandate in the Phillips case could be legislated into limbo. Congressional intent to interpret the Natural Gas Act has ever leaned toward industry, as attested by the fact that oil's cause has been espoused four times by the House of Representatives and twice by the Senate.

The Senate majority leader under the new alignment will be Lyndon Johnson of Texas, who labored heroically for industry in the 1950 ruckus over the Kerr Bill, and who told the Mid-Continent Oil and Gas Association just last October 7: "The court's ruling is wrong. Shockingly wrong."

The House majority leader will be Sam Rayburn of Texas, who during the Kerr Bill hassle dropped his gavel and descended to the floor to stiffen the ranks of industry's adherents.

And perhaps most important, in the light of the lesson taught by turn-tail Truman, who vetoed the 1950 bill, President Eisenhower has said repeatedly that he wants less federal meddling in state affairs. More tangibly, he has directed his National Fuels Resources Committee to study implications of the Phillips decree.

Nevertheless, there was no optimistic hooting from the crown block last month. There have been paper victories many, many times before. But the octopus of federal regulation clutches tighter than ever the throats of the independent gas producers.

The opposition will be determined and strong. Senators Estes Kefauver of Tennessee and William Langer of North Dakota are ready to ask for a $1 million appropriation to investigate "monopolies," including the oil and gas industries.

In a bitter attack on the FPC, which sides with industry against the High Court's ruling, Kefauver recently said he would ask the Senate anti-monopoly subcommittee "to get the fact" on the Commission's "failure" to suspend rate increases by independent natural gas producers which became effective November 1.

"What the decision amounts to is a further breakdown of regulation devised to control an essentially monopolistic industry, the field producers of oil and gas which are dominated by a handful of financial interests."

Though Kefauver is a power in the Senate, the significance of his attack does not lie solely in the votes he could muster on the ordinary, routine measure. More important is that he is politicking. He is talking for the press and the vast army of consumers who have the deluded notion that, as Kefauver says, "Gas rates to consumers will be up all over the country and the poor consumer will never know what hit him."

Others, regardless of their convictions, can be expected to follow Kefauver's example if the issue becomes enflamed as in 1950, when many a Congressman deserted the gas industry's side for fear of having his political pants burned off.

No-Strike Pledge Dropped

The Oil Workers International Union-CIO reloaded its gun last month.

Last June 4 the union made a no-strike pledge during the campaign for a 5 percent wage hike because "our employers have told us they resent having to bargain with a loaded gun on the table, by which they meant they resent bargaining under pressure of strike threats."

Local bargaining teams have now been notified to advise oil companies that the union will strike if necessary to win "a general wage increase of 5 percent or its equivalent."

The union declared that "we can only regretfully conclude that the oil industry is taking advantage of our pledge not to strike." It said wage increases have been flatly refused by all companies, with a few minor exceptions. "There have been no general wage increases granted in the industry."

Word of the new policy came within five days after another announcement to the effect that OWIU has fixed February 25 as the date for a Cleveland convention to vote on a merger with the Gas, Coke & Chemical Workers—CIO. OWIU said both unions would meet three days later in Cleveland in a joint merger convention.

The two announcements—on wages and mergers—were apparently unrelated, but recent events indicated otherwise. The Gas, Coke & Chemical Workers have of late viewed the merger with less enthusiasm. The reason: Dave McDonald's CIO steel workers reportedly offered them a million-dollar organization fund to turn their back on OWIU and sign up with the steel workers. Shortly after that report, the Gas, Coke & Chemical workers suddenly abandoned plans for a September merger meeting with OWIU. This was widely interpreted as a stall to give the Gas, Coke & Chemical Workers time to weigh the steel workers' offer.

Moreover, OWIU has all but failed in its drive to draw AFL and independent unions into a proposed coalition. Of the more than 20 unions which attended the original coalition organization meeting last spring, only OWIU has ratified the plan. The rest have held back, apparently fearing they will lose their autonomy in a coalition with the big 120,000-member OWIU.

Thus, by threatening to strike unless given a 5 percent wage increase, OWIU could have been lifting a battle pennant under which the other unions—Gas, Coke & Chemical along with the AFL and independents—could be lured with the promise of booty for all.

'Nice Monopoly'—That's Us

The U. S. oil industry is one of the nicer monopolies.

This public conception of our industry was revealed once more at the hard core of the progress report delivered at the Chicago API meeting by G. Stewart Brown, outgoing chairman of the Oil Industry Information Committee.

Thus, if it is conceded, as it must be, that the odious "monopoly" brand is responsible for many of industry's ills, it is apparent that our progress, public relations wise, is in being advanced from "monopoly" to "nice monopoly." Industry is run by a group of giants, the public holds, but fortunately they are civilized giants who don't starve little children by cutting off the gasoline supply of milk trucks.

Brown reported on the findings of Dr. Claude Robinson, president of Opinion Research Corporation, retained to make an "impartial outside evaluation" of the OIIC program. Robinson found this:

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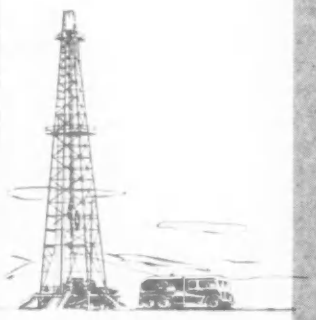

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prices, the over-all favorable impression of the oil industry has risen from 69 to 72 percent between 1946 and 1953."

Robinson also found: "The OIIC has succeeded in making the public more conscious of competition in the industry. A large majority, however, still believe that a few big companies dominate the oil industry and that this is not good."

In a frank appraisal that showed a commendable grasp of industry's basic problem, Brown cited three shortcomings in the OIIC effort:

- The committee has been too modest in asking industry for enough money and manpower.
- OIIC has been using a shotgun to hit all targets instead of a cannon to knock over the big ones.
- OIIC has been slow to enlist greater participation from more segments of the industry. "Most of our volunteers come from the marketing side of the indstury, which is fine. But we need more representation from producing, manufacturing, research and other important parts of the industry. This is something we intend to work on next year."

Information Program Set

So the public can be given information on the development of adequate natural gas and oil resources, an information program will be conducted by the new Natural Gas and Oil Resources Committee, which will be headquartered in New York City.

Committee chairman is L. F. McCollum, president, Continental Oil Company; vice chairman is Paul Kayser, president, El Paso Natural Gas Company. Baird H. Markham, former American Petroleum Industries Committee director, will serve as the committee's full-time director.

Thanks to construction during the past few years of many long distance transmission lines from Mid-Continent and Southwest fields, natural gas is being used by many new consumers unacquainted with problems confronting the development of new supplies necessary to meet growing demands, McCollum said.

Consequently, he added, new consumers as well as others are entitled to know the facts regarding their future gas supply. Toward that end, the committee plans to present the facts to interested groups throughout the U. S., in addition to the public at large.

Texas Allowable Upped

The Railroad Commission decided last month that it's futile to cut back Texas production so long as other regions remain eager to supply the market with the difference.

"Other areas have been taking the Texas market," noted Commissioner Olin Culberson. "Perhaps we have given too much weight to nominations, without regard to the economic effect on producers and royalty owners." Result: The Commission raised the December allowable 64,374 barrels daily. This month's quota, based on 16 days' production, will average 2,961,782 barrels daily. Assignments to new wells will increase the amount by about 35,000 barrels daily.

Six majors recommended the 16-day schedule for the 31-day month. By comparison, the schedule for 30-day November was for 15 days.

Reports to the Commission showed U. S. imports of crude and products to be 917,442 barrels daily for October. Schedules for November called for an average of 1,033,433 barrels daily, and for December, 1,048,047.

Monument to Conservation

Last month at Oklahoma City a monument was dedicated to oil's cherished, half-won principle of sensible conservation without the blight of federal intervention.

The monument is a $75,000 building to house the Interstate Oil Compact Commission. Built with funds provided by a legislative appropriation from funds built up by taxes on oil and gas production, the one-story brick and stone structure was deeded, along with the land it occupies, to the Compact for as long as its offices remain on that site.

Just the right note was struck at the dedication ceremonies by S. L. Digby, member of the Federal Power Commission who has been hammering away at the shackles which the Supreme Court forged in the Phillips gas case. Digby aptly paraphrased the Compact's aims thusly:

"The matter of regulation in the interest of conservation is the right and responsibility of the respective states. Any encroachment upon this right by the federal government will prove to be harmful to the public interest."

Oil Causing Less Smog

Los Angeles' smoggy air was no easier to breathe last month, but fewer Californians were turning up their noses at the oil industry.

The Western Oil and Gas Association's latest summary of hydrocarbon control measures declared that emissions for which the industry's production, refining and distribution activities are responsible have decreased by 35 percent in 11 months. Refinery operations, which generally draw sharp blame, are now said by the Association to account for only 140 tons daily of hydrocarbons. This is just 9.4 percent of the total emissions.

In an effort to relieve the beleaguered Coast, Interior Secretary McKay ordered three Bureau of Mines technicians to Los Angeles. The action followed an appeal from Governor Knight for government technical aid.

Gulf Tracts Draw Top Bids

Bids submitted in the November 9 federal sale of oil and gas leases in the submerged lands of the outer Continental Shelf off Texas pointed squarely at those tracts major oil companies believe most promising.

Thirty-eight tracts, comprising almost 112,000 underwater acres, located in the Mustang Island, Matagorda Island, and High Island areas were offered by the Interior Department's Bureau of Land Management. However, only half of the tracts drew bids, with seven majors submitting high bids totalling $23,357,029 for the 19 tracts.

The highest bid was turned in by Standard Oil Company of Texas, the first company to bring in oil production in deep Texas tidelands, when it bid $4,565,251 for Tract 37, High Island area, which comprises 5760 acres. Phillips Petroleum Company bid $4,166,000 for that tract. In all, Standard got six tracts.

Highest per-acre bid was submitted by Magnolia Petroleum Company for a tract 10 miles southeast of the Standard tract which is 18 miles offshore—$2209 an acre for a total of $3,180,960.

The high bids on the 19 tracts on which offers were received were:

Tract No. 1, the Atlantic Refining Company, Dallas, and Tide Water Associated Oil Company, Houston, joint bid, $2,250,017, or $400.81 an acre.

No. 2, Atlantic and Tide Water, joint bid, $3,650,017, or $653.78 an acre.

No. 3, Atlantic and Tide Water, joint bid, $106,000, or $19.09 an acre.

No. 5, Gulf Oil Corporation, Houston, $93,888, or $16.30 an acre.

No. 7, Atlantic and Tide Water, joint bid, $106,000, or $18.40 an acre.

No. 8, Gulf, $152,720, or $26.51 an acre.

No. 9, Atlantic and Tide Water, joint bid, $76,000, or $26.39 an acre.

No. 14, Phillips Petroleum Company, Bartlesville, Okla., $750,666, or $521.29 an acre.

No. 16, Phillips, $250,666, or $174.07 an acre.

No. 17, Magnolia Petroleum Company, Dallas, $1,694,880, or $1,177 an acre.

No. 18, Magnolia, $3,180,960, or $2,209 an acre.

No. 19, Standard of Texas, $1,940,000, or $1,347.22 an acre.

No. 20, Continental Oil Company, Houston, $777,007, or $539.58 an acre.

No. 26, Standard of Texas, $1,780,000, or $1,236.11 an acre.

No. 27, Standard of Texas, $251,000, or $174.30 an acre.

No. 31, Standard of Texas, $802,200, or $557 an acre.

No. 34, Standard of Texas, $826,749, or $143.53 an acre.

No. 36, Continental, Atlantic and Tide

Water, joint bid, $103,000, or $17.88 an acre.

No. 37, Standard of Texas, $4,565,251, or $792.57 an acre.

Kerr-McGee Bids Released

The U. S. government has returned to Kerr-McGee Oil Industries, Inc., $2,932,800 which the company put up when it filed the wrong bids on federal oil lands in the Continental Shelf off Louisiana.

The bids were submitted at the government's first outer continental leasing sales October 13. On the following day, Kerr-McGee discovered it had made an error in describing the desired parcels.

Return of the one-fifth deposit required for bidding on the nine disputed oil and gas leases followed a holding by Acting Comptroller General Frank H. Weitzel that ". . . It is a fundamental principle of law that the acceptance of a bid with knowledge of an error therein does not constitute a valid and binding contract . . ."

U. S. Royalties Up $7 Million

The U. S. netted almost $7 million more in 1953 from royalties on oil and gas leases on federal lands than in 1952, the Interior Department reported.

Royalty returns last year were $38,192,300, compared with $31,586,400 in the previous year.

Production from federal lands in 1953 included almost 112 million barrels of oil, 239 billion cubic feet of gas, and 207 million gallons of gas liquids. At the close of 1953, there were 85,873 leases outstanding on federal lands, of which 2924 were productive. The drilling record for the year was 755 producers and 414 dry holes.

U. S. to Take Iran Role

The U. S. State Department, after recent high-level discussions, has reversed its decision to stay out of the Iranian oil consortium operations. It has decided to play a mild hand by helping independent companies interested in buying into the consortium make their requests known to the consortium members.

Under the terms of the Iranian pact, independents may apply for what amounts to be another seat at the table now filled with eight companies any time within six months from the date of the pact. The agreement was signed October 29, thus, April 29, 1955, is the deadline.

The consortium members probably will publish soon the eligibility requirements for the purchase of portions of the block of stock reserved for independents under the agreement. There is every indication that the State Department will not take the responsibility of overseeing the formation of any new amalgamated independent company joining the consortium.

In brief . . .

The Supreme Court upheld, in effect, the validity of franchise and excise taxes imposed by the state of Tennessee on Texas Gas Transmission Corporation. The High Court refused to review a decision of the Tennessee Supreme Court against the company. The Tennessee court had held that taxes were levied on the privilege of doing business in the state, not on interstate business.

•

Humble Oil & Refining Company was the first of 17 high bidders for oil and gas leases on 83 federal land tracts off the coast of Louisiana to receive a fully executed contract for exploration under the Outer Continental Shelf Act of 1953, the Interior Department announced.

•

Tide Water Associated Oil Company stockholders approved a recapitalization plan. Under the plan, stockholders other than those of Mission Development Company, Mission Corporation and Pacific Western Oil Corporation are being given the opportunity until December 8 to exchange, on a share-for-share basis, all or any part of their common stock holdings for $1.20 cumulative preferred stock of $25 value.

•

A new Office of Strategic Information has been set up in the Commerce Department to promote voluntary efforts to prevent strategic data from reaching foreign nations. Commerce said censorship is not intended.

•

Coastal Terminals of North Carolina, Inc., purchased 27 acres at Wilmington, N. C., for construction of a 175,000-barrel deep-water terminal scheduled for completion in four or five months. An ultimate outlay of $500,000 is expected.

•

Sixty-two pipe line firms with annual operating revenues of more than $500,000 each, reported transportation revenues totaling $139,873,063 for the third quarter. This was a .4 percent increase over the 1953 third quarter.

•

Service Pipe Line Company claimed a record with the completion of a 630-mile crude line from Fort Laramie, Wyo., to Freeman, Mo. The 20-, 22- and 24-inch line was completed in 61 days for an average of ten miles of pipe laid per day. Line was laid by Western Pipe Line Company, of which Service is parent. Initial capacity is 178,000 barrels per day.

Stock Edict Appealed

Richfield Oil Corporation, Los Angeles, has appealed a National Labor Relations Board edict to the effect that it must bargain with the CIO Oil Workers on an employe stock-purchase plan already in existence. The appeal now is in the U. S. Circuit Court of Appeals. Richfield lawyers said they would follow "all the due processes of law available" to try to have the NLRB ruling reversed. So the issue may ultimately wind up before the Supreme Court.

The board's 3-to-1 decision was made October 19, serving notice on industry that, once companies contribute to union employe stock-purchase plans—as did Richfield—the plans become part of contractual "wages and working conditions."

The labor board's decision held that Richfield, by refusing to negotiate the issue with OWIU Local 128 at Long Beach, was guilty of an unfair labor practice.

These viewpoints on the matter were voiced by NLRB, management and its lawyers, and the union:

- NLRB—majority opinion held that "it is now well established that the term 'wages' comprehends all emoluments of value which may accrue to employes out of their relationship" . . . and . . . "in our opinion, a stock-purchase plan of the character before us is embraced by this statutory term of the Taft-Hartley Act . . ."
- Richfield—the company argued that neither wages nor working conditions were issues because participation in the plan "is neither a condition of hiring nor a condition to continued employment; both the employer and employe may withdraw at any time."
- Union—Chief O. A. (Jack) Knight said, "We do not consider this a new gain, but rather a re-confirming of a basic bargaining right we have had for many years and which we have exercised on many occasions with many employers."

He included in this category Sinclair Oil Corporation, Socony-Vacuum Oil Company, The Atlantic Refining Company, Continental Oil Company, The Pure Oil Company, and Standard Oil Company of California.

"There is no indication that managements of these companies have been crippled by such negotiations," said Knight.

Gas Control Flayed

The view that government regulation of prices could destroy the incentive required to find greater sources of oil and gas—expressed widely by industry leaders since the Phillips case decision—has been given additional support from Senator Antonio J. Bermudez, general managing director of Petroleos Mexicanos, the Mexican government's own oil agency.

While doubting the propriety of a

foreigner commenting on developments in the U. S., Senator Bermudez did say that he thinks "that no government agency in the world can rule the law of supply and demand" and ". . . Action holding prices down is not found to be effective as an incentive to the discovery of new sources of production."

Bermudez also pointed out that Pemex recently signed a contract, running for three years, with an unidentified U. S. oil company which will result in Mexico exporting to the U. S. 10,000 barrels a day. It was not specified whether the exports would be crude or products.

Westbound Traffic Only!

For the petroleum industry, increased international oil trade traffic from one direction and a congestion of new refining capacity at the other is resulting in a one-way operation.

Already dwindling U. S. oil exports soon will be entirely choked from the trade lanes. Though never a big factor in world petroleum export markets, the U. S. until 1948 was able to more than offset its crude oil and residual imports by shipments of refined products, mostly to Europe, and export of a small volume of crude oil primarily to eastern Canada.

Construction of new refinery capacity abroad in the postwar years, first in the Middle East and more recently in Western Europe, has resulted in a more than ample supply of finished oil products in the Eastern Hemisphere. Western Europe, which only produces 2.5 percent of its crude oil needs, in 1953 became a net exporter of refined petroleum products. The region's export shipments of products only amounted to an average of 24,000 barrels daily in that year, but for 1954 the average is estimated at 100,000 barrels per day, of which 80,000 barrels daily is gasoline. The growth of net European exports can be expected to continue.

The salient statistics of European refinery growth are reported in the fourth survey of the Oil Committee of the Organization for European Economic Recovery, a growth that has been financed in a small part by loans and grants from the U. S. Government, a larger extent by investments of U. S. international oil companies abroad and still a greater extent by European capital investments in new petroleum refining capacity.

Figures cited in the study place total refining capacity of OEEC nations—all of Western Europe, plus the United Kingdom—at the end of 1953 at 2,008,000 barrels daily, a gain of 366,000 barrels daily since the end of 1952. Additional expansion, now under way or planned, will increase the OEEC nation's total petroleum refining capacity to 2,246,000 barrels daily by the end of 1956, according to the report. Of the total crude throughput capacity expected by the end of 1956, 480,000 barrels daily will be cracking capacity and 360,000 barrels daily will be catalytic cracking capacity.

The growth of refining capacity in Western Europe is the result of a need to reduce dollar expenditures for refined products imports which had been supplied largely by American companies and to replace them with lower cost crude imports from sterling producing areas, primarily the Middle East.

In addition to the expansion in European refinery capacity, important refinery expansion programs are under way in Australia, India and Pakistan. New capacity has been completed in 1954 in South Africa and at Aden on the Red Sea.

Depletion Allowance Attack?

Ever sensitive to flank attacks on the depletion allowance, industry was turning a hard, cold stare on Treasury Department questionnaires last month.

The Mid-Continent Oil & Gas Association warned its membership that " . . . the Internal Revenue Service is now engaged in collecting depletion statistics from all taxpayers whose income consists of 'receipts from mineral extraction,' including oil and gas companies and operators."

The Association then threw up its defense: "Since there appears to be no doubt but that the Internal Revenue Service is assembling these depletion statistics for the purpose of making recommendations of some nature to the Congress, it is the feeling of the Association's Special Depletion Committee that identically the same information as is provided to the Internal Revenue Service by oil and gas operators should be made available in a confidential manner . . . to the Association."

The Association plans to study the totals in the hope of determining what Treasury is up to.

To Study Pipe Line Need

A non-oil committee was named last month by the Office of Defense Mobilization to study a proposal for a government-backed crude line from Texas to California.

Charles S. Cheston, Philadelphia industrialist; Palmer Hoyt, Denver publisher; and Charles A. Thomas, chemical company executive, were appointed to assess the problem of petroleum transportation to the West Coast, the availability of crude and products for military use in the Pacific, and to analyze the capacity of refineries in the area to meet emergency requirements.

The group was not expected to take up any new problems, but to evaluate previous reports, including recommendations by the Oil and Gas Division and the military, which had found that a Texas-California line would be desirable in an emergency. Neither, however, advocated government aid.

Oil men were left off the committee because ODM wanted to avoid possible charges that the findings were dictated by oil interests.

State Oil Law Opposed

A California oil conservation law would be unnecessary and harmful, Reese H. Taylor, president, Union Oil Company, Los Angeles, told the San Joaquin Valley Oil Producers Association recently after praising the state's producers for their voluntary conservation efforts. Earlier this year, Charles S. Jones, president, Richfield Oil Corporation, Los Angeles, spoke to the association in behalf of such a law.

Recognizing the value of strengthening "confusing" and "too loosely drawn" sections of the state Public Resources Code to restrict production of gas from wells with excessive gas-oil ratios, Taylor said he opposed any law which would result in compulsory unitization, gear production to market demand or which would discard the so-called "rule of capture" as legal basis for oil holdings.

Taylor said, however, he would favor a state law sanctioning the work of the Conservation Committee of California Oil Producers.

In rebuttal to Jones' statement that industry almost drowned itself in its own product over-production period, Taylor said, "There are far more operators facing financial ruin right now under the so-called benevolent protection of the conservation laws of Texas, Louisiana and Oklahoma, and other states, where production during the past 18 months has been cut from 40 percent to 50 percent, than at any time during the '20s and '30s in California."

Taylor also said he would like to point out that, through such laws, production in many states has been decreased by as much as one half of MER largely to make room for imports.

Interest Up in W. Texas

Another completion of an Ellenburger well—for a potential flow of 3572 barrels a day—in the Dora Roberts Ranch area in Midland County, West Texas, is another support to the description made by companies operating there that the area is one of the most important oil discoveries in recent years. **(See Page 72.)**

The latest well, C-1-1, is a southwest offset to Cities Service Parks 1, which was recently brought in for more than 3000 barrels a day. C-1-1 is owned by Cities Service and Forest Oil Company, which jointly hold 15,000 acres under lease on Dora Roberts ranch.

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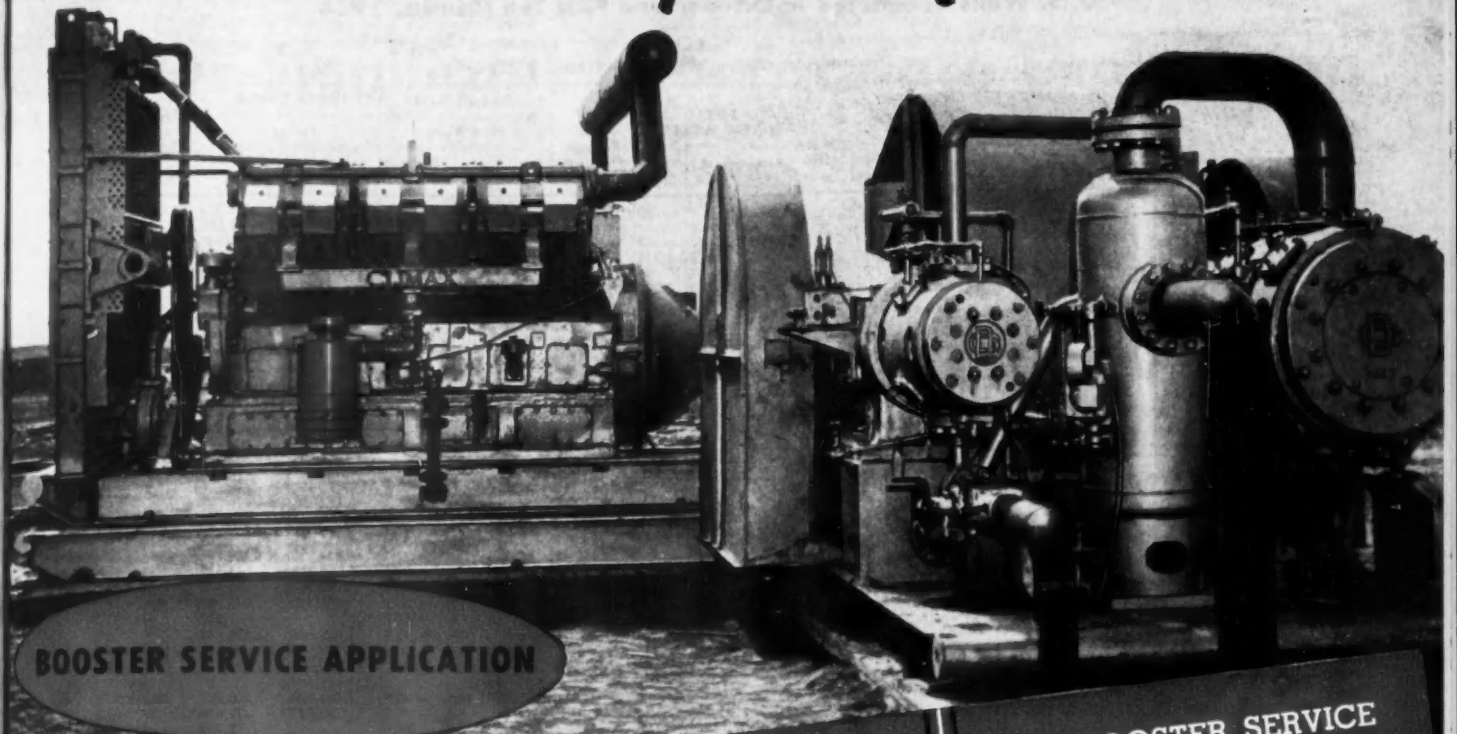

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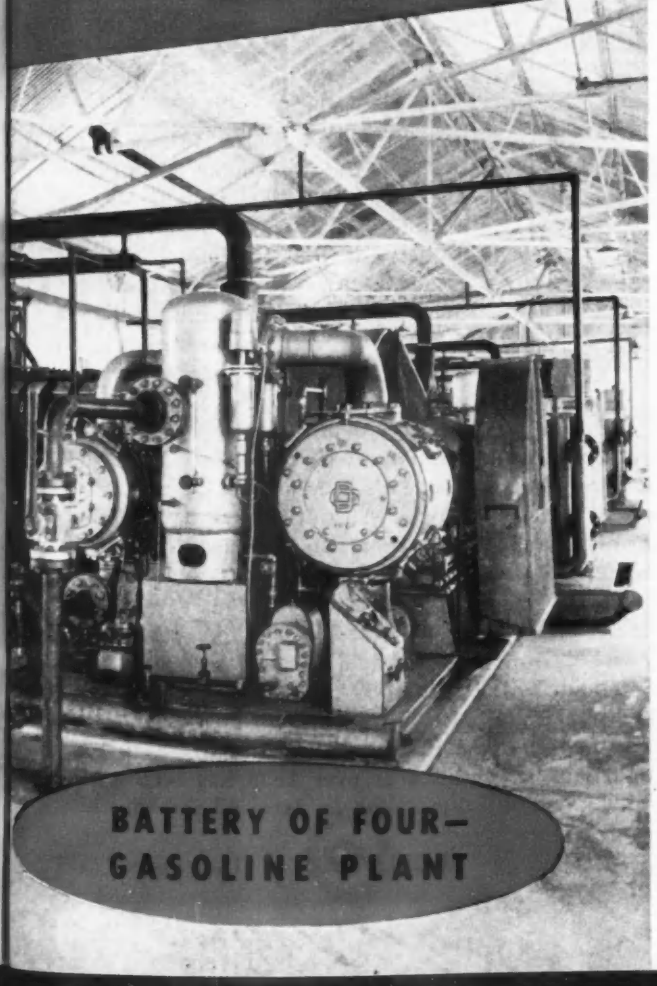

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Representatives in All Principal Oil Fields of the World

U. S. Wells Completed in October and First Ten Months, 1954

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED															Rigs in Operation		
								TOTAL NEW WELLS			Total Footage October, 1954	DETAILS FOR JANUARY-OCTOBER						
												New Wells			Footage			
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Oct., 1954	Sept., 1954	Oct., 1953		1954	1953	Percent Diff.	1954	1953	Oct. 31, 1954	Sept. 30, 1954	Oct. 31, 1953
Alabama				5				5	4	10	29,564	62	89	— 30.3	330,279	459,522	7	4	7
Arizona												8	6	+ 33.3	30,774	19,960		1	1
Arkansas	30			20				50	68	62	171,712	490	429	+ 14.2	1,723,845	1,589,947	28	31	48
California	85		5	55			1	146	195	269	739,423	1,995	2,183	— 8.6	9,135,520	9,531,867	239	203	261
Colorado	33		6	79				118	94	58	630,545	1,074	573	+ 87.4	5,899,221	2,954,392	78	60	72
Florida				1				1	2	1	11,597	27	29	— 6.9	170,611	185,437	2	3	3
Georgia				1				1		2	2,500	8	7	+ 14.3	20,508	19,309		1	2
Idaho													4	—100.0		22,748			
Illinois	168		1	158	3			330	292	276	826,426	2,638	1,739	+ 51.7	6,448,690	4,326,940	309	292	254
Indiana	20		2	56				78	91	127	118,004	715	1,108	— 35.5	1,084,737	1,860,894	118	124	182
Kansas	161		20	126			2	309	379	322	1,140,860	3,484	3,779	— 7.8	12,352,281	13,101,071	414	412	435
Kentucky	38		15	60	1			114	110	106	212,552	1,144	1,079	+ 6.0	2,141,537	2,115,585	91	93	91
Louisiana	177	9	26	81				293	356	280	1,897,210	2,981	2,163	+ 37.8	18,558,414	15,158,399	297	273	270
North Louisiana	106	1	9	39				155	210	148	495,887	1,578	953	+ 65.6	4,676,782	3,461,945	68	60	64
South Louisiana	71	8	17	42				138	146	132	1,401,323	1,403	1,210	+ 16.0	13,881,632	11,696,454	229	213	206
Maryland										1			5	—100.0		19,715	4	5	1
Michigan	28			23			1	52	51	60	172,138	465	508	— 8.5	1,258,633	1,315,955	103	101	97
Mississippi	16	1	2	23				42	38	53	286,222	352	340	+ 3.5	2,459,158	2,346,034	46	47	34
Missouri				2				2			2,267	11	25	— 56.0	11,798	20,645	1	2	1
Montana	12			10				22	36	43	96,826	281	369	— 23.9	1,111,025	1,611,706	41	36	41
Nebraska	17		1	24				42	52	19	237,981	367	274	+ 33.9	2,047,289	1,419,871	21	27	15
Nevada				1				1			4,938	11	8	+ 37.5	56,156	11,115	3	3	1
New Mexico	42	2	27	15				86	119	124	501,662	985	1,227	— 19.7	5,242,367	6,940,010	111	115	168
New York	13				8			21	43	81	29,007	472	772	— 38.9	687,403	1,076,900	57	64	107
North Carolina													1	—100.0		1,570			
North Dakota	12			16				28	27	23	187,314	238	212	+ 12.3	1,658,646	1,575,978	22	27	31
Ohio	42		38	39				119	73	84	239,984	893	805	+ 10.9	1,739,143	1,640,341	193	188	195
Oklahoma	361	3	43	200	3		1	611	554	613	2,157,759	6,605	6,002	+10.0	22,519,965	21,098,171	711	700	568
Oregon																	1		
Pennsylvania	18		16	7	13	5		59	62	148	123,259	809	1,360	— 40.5	1,484,880	2,350,006	132	131	271
South Dakota				1				1		2	2,186	17	16	+ 6.3	92,827	79,610	1	2	5
Tennessee													1	—100.0		2,269			
Texas	783	31	56	539	5		3	1,417	1,545	1,529	6,101,273	15,224	14,069	+ 8.2	68,309,220	64,352,690	1,261	1,239	1,375
Dist. 1: South Central	42			44				86	120	96	289,166	928	710	+ 30.7	3,093,314	2,272,380	45	33	38
Dist. 2: Middle Gulf	26	9	2	29				66	79	65	432,673	683	651	+ 4.9	4,167,595	4,009,710	49	30	51
Dist. 3: Upper Gulf	70	5	3	54			1	133	142	131	825,778	1,453	1,365	+ 6.4	9,716,677	9,196,179	125	123	129
Dist. 4: Lower Gulf-S.W.	41	14	10	46				111	102	176	552,550	1,200	1,556	— 22.9	6,253,945	8,892,794	70	60	89
Dist. 5: East Central	2		2	10				14	25	16	59,507	227	231	— 1.7	866,995	932,292	19	11	13
Dist. 6: Northeast	29	2	12	18				61	72	46	346,598	605	417	+ 45.1	3,542,094	2,500,095	61	52	51
Dist. 7-B: North Central	119		2	115			1	237	291	288	750,326	2,450	2,611	— 6.2	7,828,100	8,464,031	126	127	130
Dist. 7-C: West Central	54		2	32				88	118	104	492,115	1,080	1,115	— 3.1	5,633,898	5,487,188	118	140	145
Dist. 8: West	159	1	1	29				190	243	245	1,135,267	2,384	1,930	+ 23.5	14,176,293	11,092,243	329	343	350
Dist. 9: North	207		1	154	5		1	368	274	311	1,003,546	3,403	3,041	+ 11.9	10,327,730	10,122,054	254	240	271
Dist. 10: Panhandle	34		21	8				63	79	51	213,747	811	442	+ 83.5	2,702,579	1,383,724	65	80	108
Utah				9				9	11	9	46,009	56	67	— 16.4	264,223	365,196	25	29	24
Washington																	1	1	1
West Virginia	2		45	7				54	72	50	157,381	468	516	— 9.3	1,359,865	1,442,946	175	171	210
Wyoming	64		1	31				96	69	96	515,438	975	690	+ 41.3	5,148,303	3,485,154	89	82	168
Total United States	2,122	46	304	1,589	33	5	8	4,107	4,343	4,448	16,642,037	42,855	40,363	+ 6.2	173,347,318	162,318,088	4,581	4,467	4,939
Total Western Canada	103		19	84				206	151	188	739,913	1,744	1,834	— 4.9	6,857,443	7,558,226	142	121	121

Completions Set Record

Ten-months' total of 42,855 greatest volume for any comparable period.

WELLS COMPLETED in ten months this year totaled 42,855 for the greatest volume of drilling ever done in any comparable period. With current drilling rates remaining on the same high level that has characterized this year's campaign, the next two months should see total wells rise to almost 51,000, which would not only be a new all-time peak, but would be the first time the long-sought 50,000-well mark was reached.

While the number of wells completed is of prime importance to the industry, a far better measure of effort expended by the nation's drillers is the amount of footage penetrated in those wells. And it is in this department that even greater records are being set. In ten months, a total of 173,347,318 feet was drilled in this year's wells. That was 11 million feet more than was recorded during the same period of record-breaking 1953. By the end of the year, that total will have risen to about 206 million feet of hole drilled, and that would be the first time the tremendous task of drilling 200 million feet of hole was accomplished in a single year.

Most of the increase in footage drilled over last year's record has been the result of the 2492 additional wells drilled; however, a contributing factor has been the slight increase in each well's average depth. This year, the average depth has been 4045 feet compared with the 4021-foot depth of last year's average well.

This year's operations have not only been more voluminous than 1953's, but they have apparently been more productive. So far 26,649 wells have been successfully completed as producers, and that was 2560 more than the 24,089 producing wells drilled in last year's 10 months. That means that every additional well completed this year over 1953 has been a producer with an extra 68 thrown in.

Deltas Significant in Subsurface Exploration

• Many lenticular bodies of sand containing oil and gas are closely related to deltaic environment of deposition.

• Exploratory and development work will be aided by better understanding of deltas and more accurate analysis of pools related to ancient deltas.

By **DANIEL A. BUSCH,** Exploration Manager, Zephyr Petroleum Company, Tulsa

DETAILED SUBSURFACE studies in various parts of the country and in variable portions of the stratigraphic column serve as a basis for believing that many lenticular bodies of sand, known to contain oil and gas, are either deltaic in origin or closely related to a deltaic environment of deposition. Not all lenticular sand bodies are deltaic in origin, but frequently there is a genetic association of such sand types as deltas, bars, spits, hooks, etc. Detailed studies of these types of lenticular sand bodies have been made of the Upper Devonian (Venango) of western Pennsylvania, the Lower Silurian (Cinton and Medina) of eastern Ohio, the Lower Pennsylvanian (McAlester) of the Greater Seminole District of eastern Oklahoma, and the Lower Pennsylvanian (Deese and Cherokee) of central and north-central Oklahoma, and they serve as the basis for data and conclusions presented in this report.

All students of subsurface geology are familiar with the following anomalous conditions associated with lenticular bodies of sand:

- Differential compaction of shales surrounding a lenticular body of sandstone.
- Abrupt facies changes.
- Superposition of lenticular sand reservoirs where structure is not the controlling accumulation factor.
- Irregular to tilted water tables.
- Dry holes in "tight zones" offset by good producers.
- Structurally high dry holes.

PART 1

Deltaic Sediments. A knowledge of the delta depositional environment sheds considerable light on the above factors. Such a knowledge, however, must be based first on an understanding of the salient features of modern deltas and their principal types. Deltas are similar to alluvial fan deposits in that the suspended materials are deposited when a river ceases to be able to carry its load. They are deposited in lacustrine (lake) and marginal marine environments, both of which serve as a base level of deposition. G. K. Gilbert, in his studies of the well-exposed deltas of glacial Lake Bonneville, observed a distinct tripartite subdivision of deltaic sediments referred to as bottom-set, fore-set, and top-set beds. Such a separation of bed types is the result primarily of a quiescent condition of a lake where

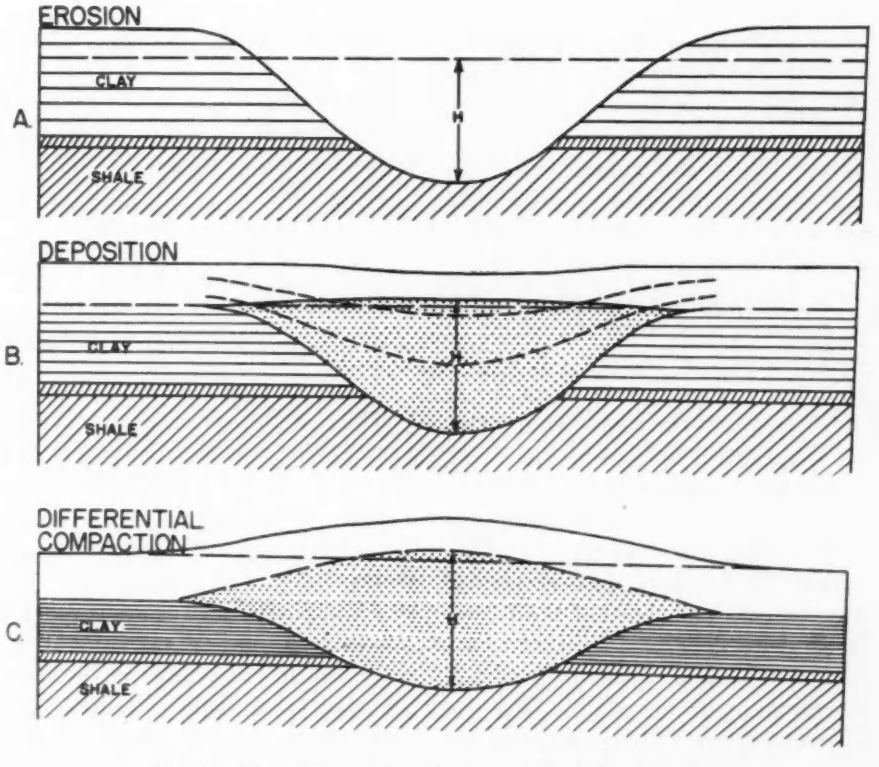


Fig. 1—Schematic profiles of channel sand development.

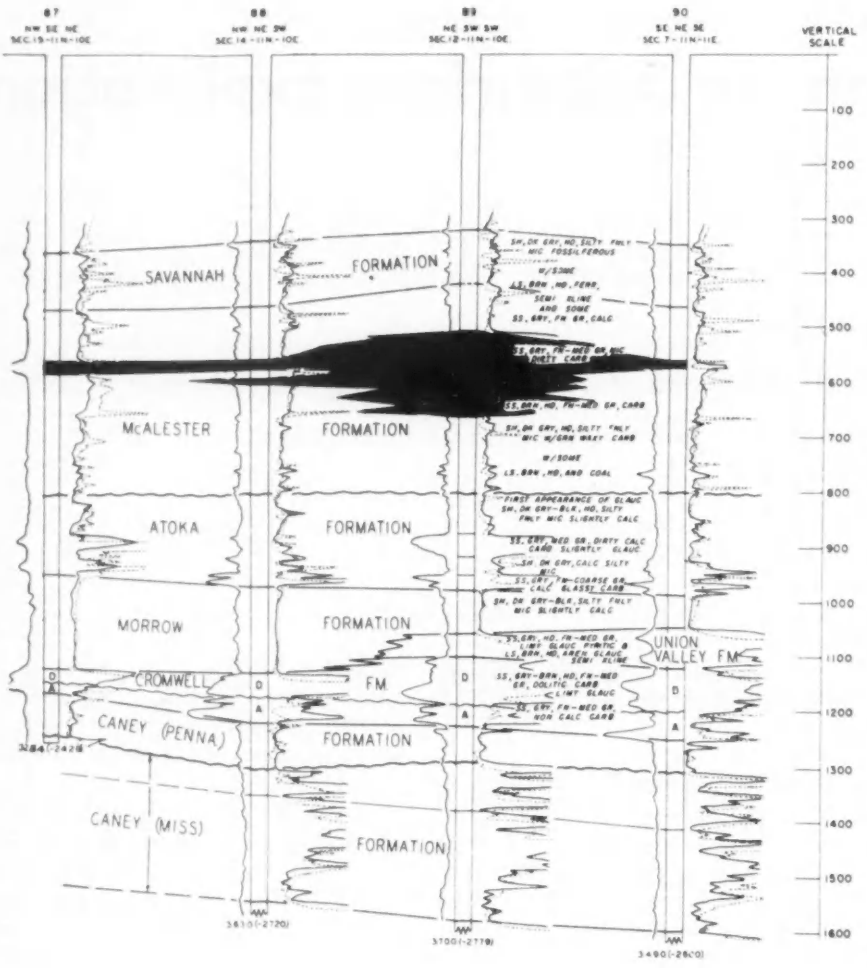


Fig. 2—Abrupt facies changes in Lower Pennsylvanian, Seminole District, Oklahoma.

there is less wave action and no tidal effects. The fore-sets, separating the bottom-sets from the top-sets, may be tilted at an angle ranging up to 30-35 degrees. It is unfortunate that this concept of a threefold subdivision of the beds of a delta has found its way into nearly all elementary textbooks on geology. The effect has been one of assuming that these three types of beds are just as readily distinguishable in deltas of marine origin. Such, however, is not the case. The bottom-set and fore-set beds, if present at all in marginal marine deltas, merge at such a low angle as to be rarely distinguishable. For example, the Mississippi River delta has no visible fore-set beds and those of the Rhone River delta slope in a seaward direction at an angle of one-half degree. Waves and currents modify the shape of such deltas causing them to be cuspate, fringed with bars, or completely reworked.

Delta Types. There are three principal types of deltas, examples of which are as follows:

Type	Example
1. Bird's Foot	Mississippi & St. Clair River Deltas.
2. Estuarine	Mackenzie River Delta.
3. Arcuate	Nile and Rhine River Deltas.

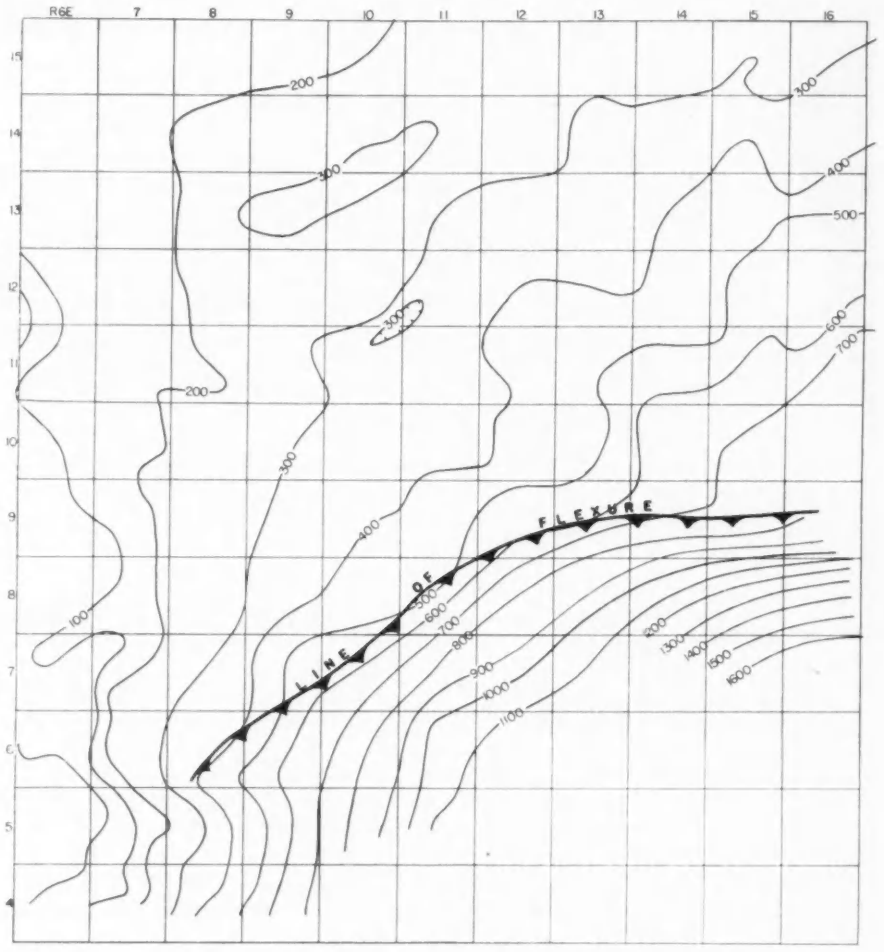
The first two types listed above are very exceptional among modern deltas and were seldom preserved in ancient sediments. The great majority of modern, as well as ancient, deltas are of the arcuate type. The rivers at whose mouths arcuate deltas are formed may transport and deposit clastics ranging in size from gravel to sand to silt to fine colloidal material and much lime in solution. The distributaries of an arcuate delta consist of an intricate system of anastomosing channels which are shallow and change position during periods of high water. It is in these distributary channels that the river clastics are deposited primarily as a result of a change in base level of deposition, i.e., subsidence with a consequent transgression or landward shifting of the environment of deposition.

When a distributary channel is filled with sand and abandoned for any reason, its response to an overburden is quite different from that of the laterally adjacent muds which comprise the sediment of the back-swamp environment. The three principal stages of differential compaction of fine clastics marginal to and overlying a channel sand are illustrated in Figure 1. The eroded channel shown in Figure 1A is filled with sand in 1B. The thickest portion of the sand, H, is not affected by the weight of the overburden, but the clay marginal to the sand body compacts as an overburden is deposited. In Figure 1C the clay marginal to the sand lens has compacted to one-half its original thickness, shown in Figure 1A. The effect on the lenticular sand is one of arching of the upper surface and a lessening of the concavity of the original channel profile (at the base of the sand). In addition, there is a slight thinning of the superjacent beds overlying the thickest portion of the sand. Such channels of sand may represent abandoned distributaries of a deltaic system. In modern deltas, such as that of the Rhine River, abandoned distributaries have a "railroad embankment" mode of topographic expression.

Such topographic features have been termed "rodden" by English geologists. In ancient deltas inclined slightly in a basinward direction a contour map of the top of the sand would show downstream (basinward) convexity of the contour lines where the individual distributary channel sands are crossed. Considerable judgment must be exercised, however, in the selection of the optimum contour interval to show this aspect of deltas by means of structural contours.

Facies Changes. Figure 2 is an illus-

Fig. 3—McAlester isopach, Seminole District, Oklahoma. Contour interval = 100 feet.



tration of an abrupt facies change in the McAlister formation of the Greater Seminole district of Oklahoma. The shaded area represents a local thickening of the Booch sand. It thickens at the base, indicating channel fill and only the upper portion is sheet-like in character. Differential compaction due to the weight of overburden produces an arching effect such as is observed in Figure 1C. Slight thinning of the overlying shale also is apparent over the thickest portion of the channel sand.

The McAlester formation of the Lower Pennsylvanian system of the Greater Seminole district of eastern Oklahoma affords an excellent opportunity for study of some of the characteristics of ancient deltas. Figure 3 is an isopach map of this formation drawn with a contour interval of 100 feet. Over most of the mapped area the McAlester formation thickens to the southeast at a fairly uniform rate. The rate of thickening increases, however, along the line labeled "Line of Flexure." This line of flexure, sometimes referred to as a "Hingeline," separates the stable shelf area of the northwest from the less stable (more rapidly subsiding) basin area of the southeast. This shelf area was the site of deposition of clays, thin limestones and coals, and sands, the latter varying considerably in thickness and lateral extent. At the "line of flexure" there is an abrupt facies change from the variable sediments of the shelf area to a lithology consisting entirely of shale in the basin area to the southeast.

Shelf Areas. The shelf area, like most shelf areas of ancient embayments, was the site of deposition of a large, complex delta. The local basinward convexity of successive contour lines in the northeastern por-

Map on Page 98
Text continued on Page 106

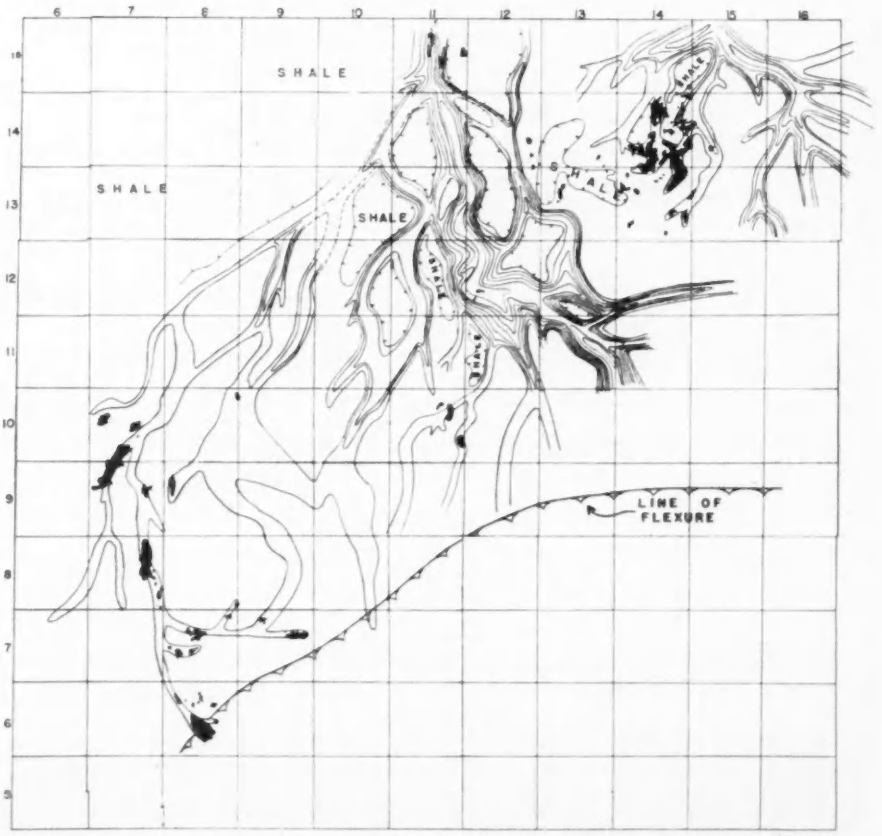


Fig. 4—Booch isopach, Seminole District, Oklahoma. Contour intervals = 25 and 50 feet.

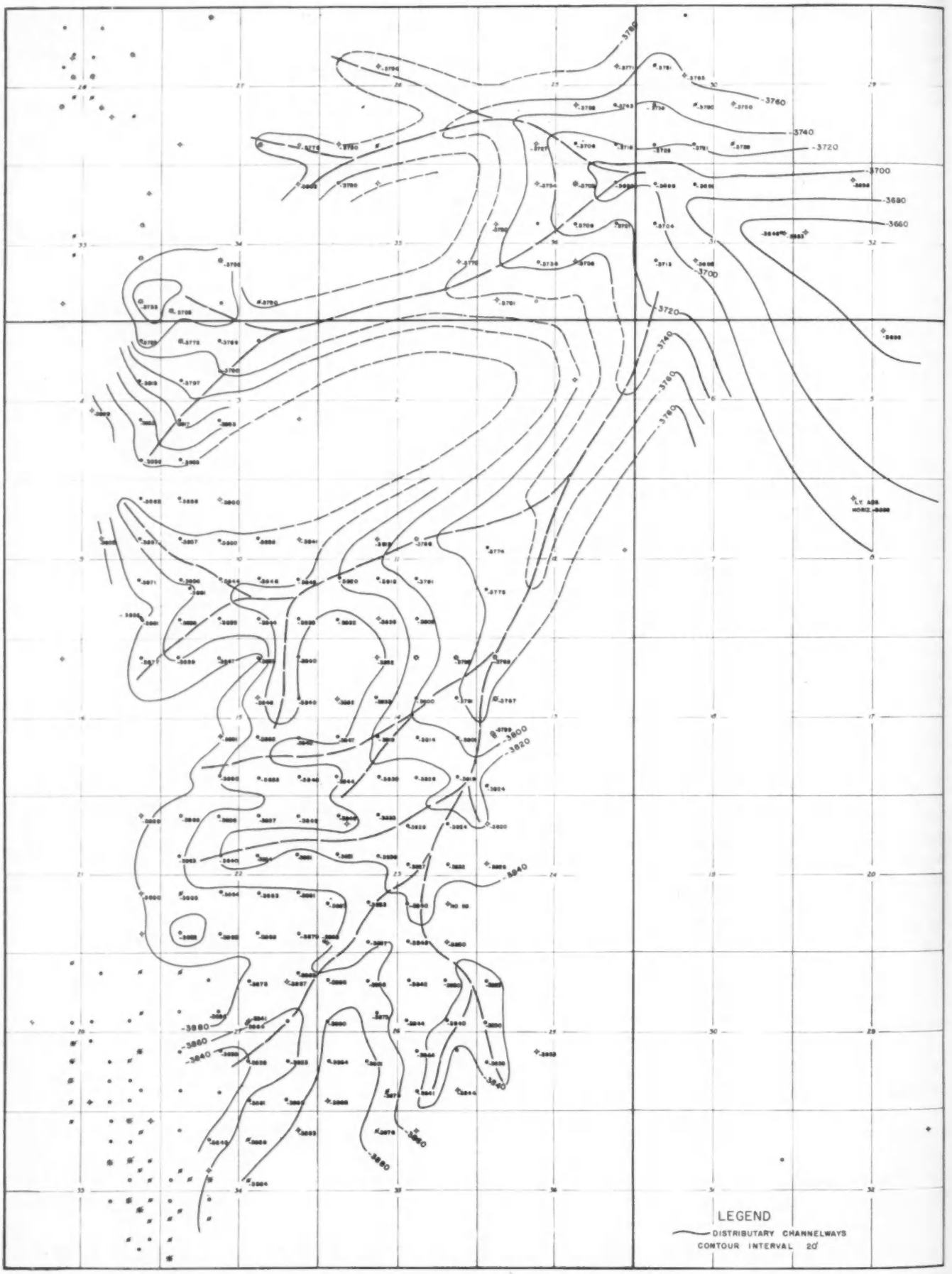
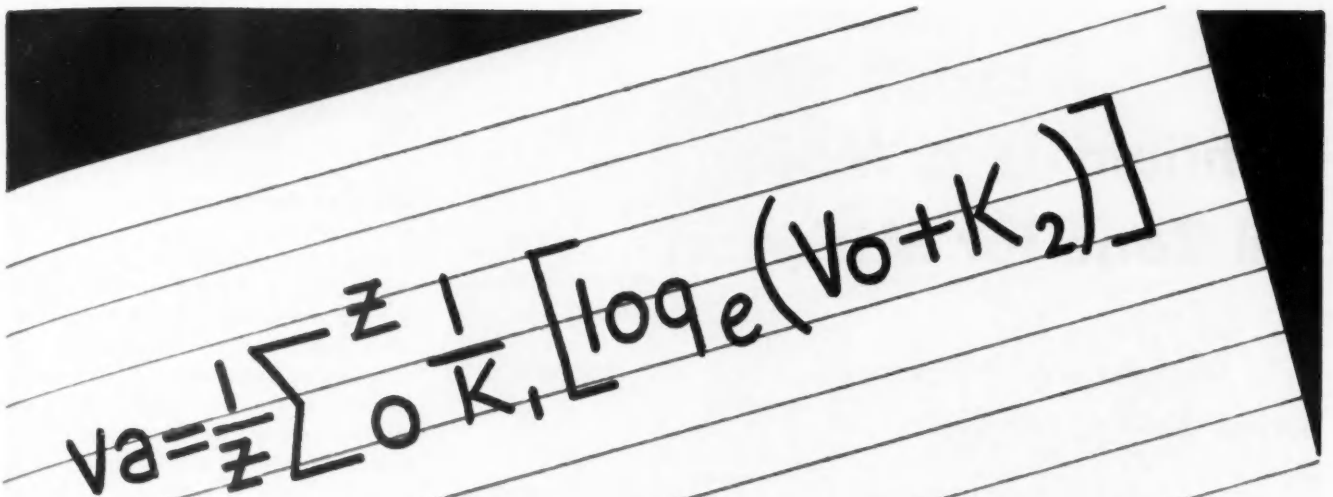


Fig. 5—Layton (Pennsylvanian) and structure in Mid-Continent area.



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WORLD-WIDE EXPERIENCE

Richfield Is a Major Oil Zone for Michigan

• Large reserves are being developed in a horizon yielding sweet oil.

• Increasing proportion of Michigan production likely to come from Richfield and deeper formations.

By GORDON H. HAUTAU, Petroleum Engineer, Conservation Department, State of Michigan, Lansing, Mich.

When Miami Operating Company tapped the Richfield zone in the old, abandoned Cranberry Lake pool of Clare County at its Bonninghausen 1 and tested an initial 372 barrels of sweet oil per day from intervals between 5016-5106 feet, it sparked a trend which will have an important result in future oil development operations in Michigan.

The Richfield zone or basal Detroit River, as it is sometimes called, is Devonian in age, and is found at depths varying from approximately 4000 to 5500 feet. For example, in the Rose City pool, Ogemaw County, it is found around 4100 feet; in the North Hamilton and Skeels fields, Clare County, it produces at depths ranging from 5075 to 5325 feet; at West Branch in Ogemaw County, production is at approximately 4000 feet.

Although it is not a new producing horizon—the first commercial Richfield zone well was completed in 1941—the Bonninghausen well demonstrated its potentialities and started a pattern of deeper drilling. The strike not only emphasized the importance of a heretofore little considered zone, but indicated that an increasing percentage of Michigan's future oil production may be expected from the Richfield and even deeper zones.

The possibilities of the Richfield zone has prompted Michigan oil operators to take "another look." And because of the new interest in the Richfield this brief review is presented to acquaint operators with the zone's broader aspects, current production practices and potentialities.

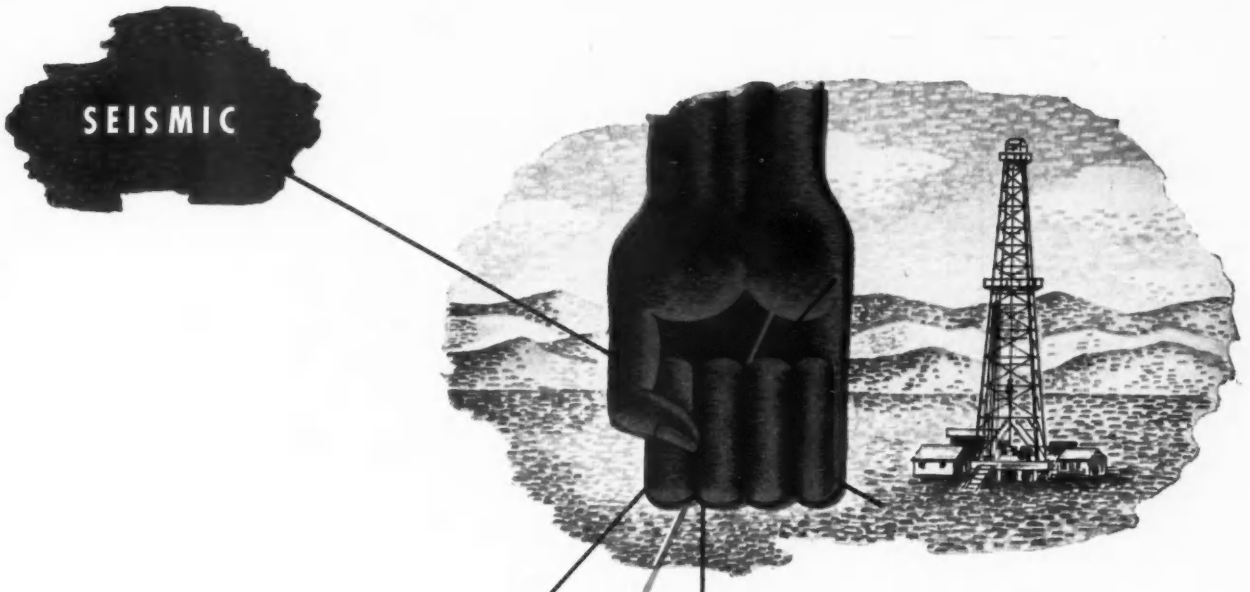
Sweet Oil. The Richfield is the section producing sweet oil, and nearly everywhere is 1200 feet to 1400 feet below the top of the Dundee Formation in the area of major development in Roscommon, Ogemaw, Crawford, Missaukee, and adjacent areas. No definite marker beds have been recognized between the top of the Dundee and the Richfield. The massive fossiliferous, black coralline limestone below the Richfield, now frequently reported on the drilling logs, apparently is an excellent marker for stratigraphic correlations throughout the producing area, but, in determining the base of the Richfield, caution must be exercised to pick the correct—the coralline—black lime.

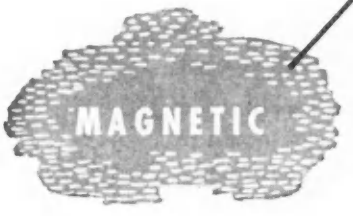
The Richfield section contains ten or more dolomite beds that range from a few inches to ten feet in thickness, separated by anhydrites and some lenticular limestones. The interval between beds varies from two to 30 feet. At least six of the dolomite beds have shown oil saturation, and four or more are considered important reservoirs. The dolomites are not saturated completely with oil. In most places, the oil is concentrated in streaks or lenses of relatively low porosity and permeability which range from several inches to a few feet in thickness.

Uniform Porosity. On producing structures the pays are limited in areal extent by the limits of porosity and permeability. In the more porous and thicker zones, the pays are limited by edge water or high percentage connate water saturation. The porosity variations are somewhat local and range from 7 to 30 percent. The average for total pay sections in individual fields is between 14 and 17 percent. Core studies and well performance data show that the porosity range throughout the Richfield producing area is relatively uniform. The dolomites are considered to be productive when permeabilities are as low as 0.5 millidarcy but only where such low permeability is associated with more permeable streaks that can act as pipe lines or carriers for the tighter portions of the pay. The permeability variations are local, and nearly everywhere are associated with porosity variations. Permeabilities range from 0.5 to 60 millidarcies with an average of 4.0 to 6.5 millidarcies for over-all pay section in the individual fields.

History. The first commercial Richfield producing well was completed in December 1941 by the Sun Oil Company in AuSable, formerly Richfield, Township of Roscommon County, in the area now known as the St. Helen oil field. This well, after acidizing, produced 150 barrels of sweet crude oil daily in initial flow tests. The development of commercial production in the zone encouraged deeper drilling and testing in other producing areas of the state where earlier drilling to shallower producing formations indicated major anticlinal structures. Many wells in the wildcat areas were set up with the Richfield or lower zones as objectives and scattered producing wells were completed in various parts of the basin.

A zone producing sour crude was encountered overlying the Richfield and several wells soon were producing oil commercially from this (Tuscola type) sour pay. The operators unfamiliar with the Richfield and observing low initial producing rates,





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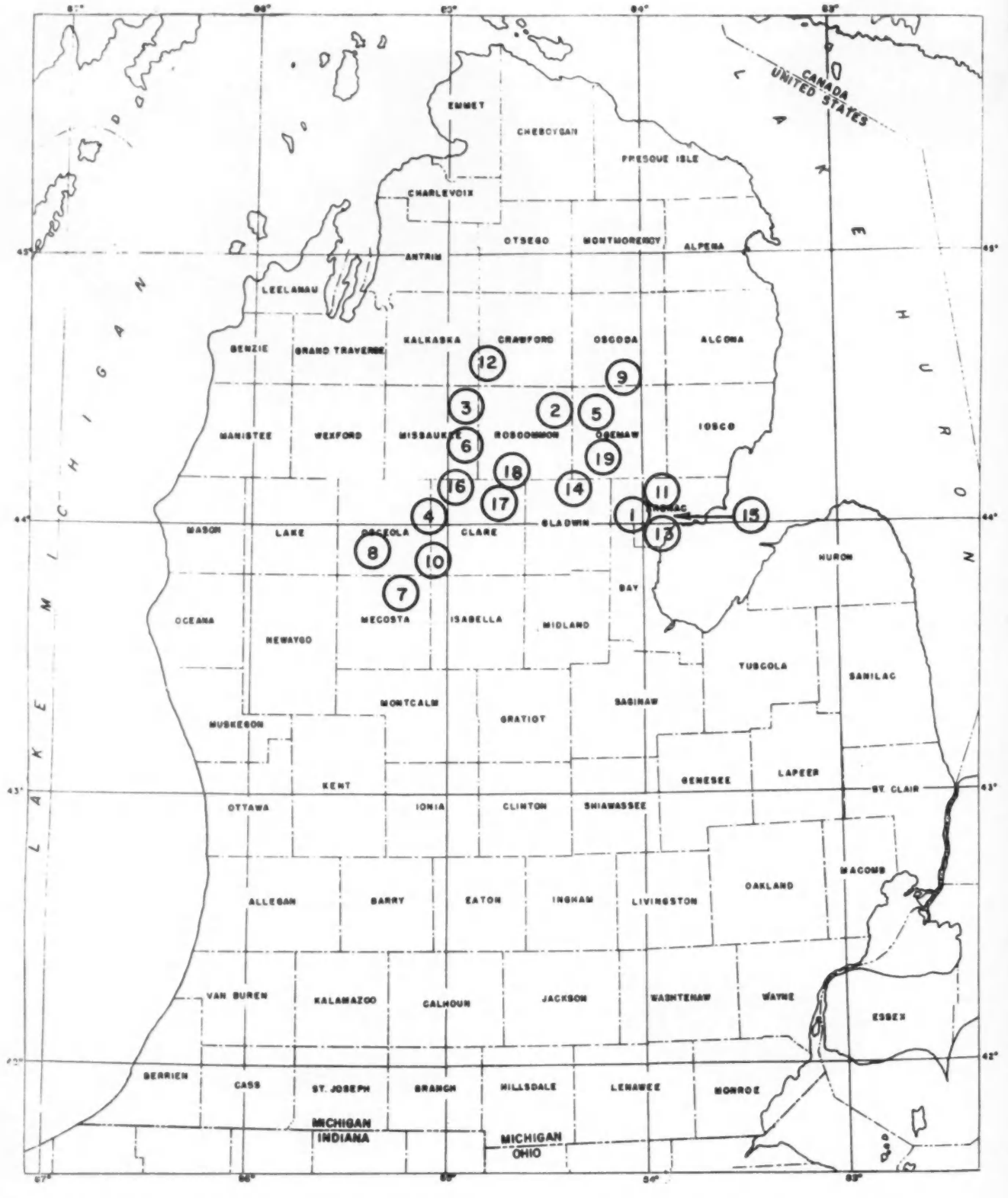

CIRCLED NUMBERS show location of Richfield development in Michigan. No. 16 marks the old, abandoned Cranberry Lake field where Miami Operating Co.'s Bonninghausen No. 1 tested 372 barrels of sweet oil per day indicating the hitherto unsuspected potentialities of the Richfield which had produced oil in small quantities since 1941.

LEGEND	FIELD	LEGEND	FIELD	LEGEND	FIELD
1	Adams	7	Fork	14	Butman
2	St. Helen	8	Cedar	15	Sterling
3	E. Norwich	9	Mio	16	Cranberry Lake
4	Winterfield	10	Garfield	17	Hamilton
5	Rose City	11	Clayton	18	Headquarters
6	Enterprise	12	Beaver Creek	19	West Branch

deemed "discretion the better part of valor," and were slow to offset wells then considered marginal producers. Time passed and the wells continued to flow and gradually wells paid off while production still remained above marginal limits. The industry began to study the records in the various areas and realized that a new and entirely different major producing zone had been found. Additional drilling of the Richfield slowly increased the area of production. New equipment, acidizing and production techniques were developed to meet the requirements of this new pay. Wells which formerly would have been abandoned now are made into commercial producers and higher initial producing rates are more common. Older wells were deepened, reworked, or reacidized where new information indicated all pays had not been penetrated. Wells showed improved performance when reacidized by new methods. Engineering studies showed the fields were gas drive reservoirs.

Eleven years after discovery, five Richfield pools were numbered among the top 15 fields of the state in daily average production. The prospects for the future look bright with development continuing at an increasing tempo in all Richfield producing areas.

Extensions and wildcat wells have reported excellent natural shows in the Richfield in several basin areas, pointing the way to new potentially major producing areas. All signs point to a continued orderly development and the application of the latest technological developments to the problems of Michigan's newest major producing zone, the Richfield.

Rate of Development. The development of the Richfield has been slow due to many factors, including: Relatively low initial production rates, low daily average producing rates and associated long pay out periods, high completion costs, above average depth of wells, and lack of adequate information on well and field recoveries based on actual performance data. Wartime shortages and emergency conditions tended to hold down development of the Richfield.

BEDROCK FORMATION MAP OF MICHIGAN

Completion Practices. Well completion practices account frequently for 25 percent of the over-all costs of the wells. Many of the rotary wells now are coring the entire producing section of the Richfield with diamond coring bits which average close to 100 percent core recovery. Rather detailed descriptions of these cores are made. Sections of the cores from pay zones are sent to laboratories for analyses to obtain data on porosity, permeability, and oil and water saturations.

Acidizing programs usually are based on core studies, if available. Spinner or electric pilot surveys are run to locate and evaluate the number of permeable zones in order to plan acidizing programs on wells spudded into the producing section. Packers of various types are used in most wells to separate pays in an effort to acidize individual pays. Under ideal conditions, each pay should be acidized separately in order to insure adequate acidization of individual pays.

Packers have been successful in many wells, but frequent failures of packers, cement, or vertical breakdown between perforations have been reported. When pipe is run through pay zones and cemented, the casing must be perforated in sections showing permeability and oil saturation.

Initial Production Rates. Before acid, many wells have showings that range from a smell of oil to several hundred feet of oil in hole. Many wells of this kind flow from 20 to 70 or more barrels per day after acid treatment. Some wells flow when drilled in, but such wells are always improved by acid treatment. Records show that 10- to 70-barrel flowing wells become 40- to 300-barrel wells when acidized.

Production Practices. Oil is produced from Richfield pays essentially

by the stop-cock method of production with short flow periods and relatively long shut-in periods. The wells are shut-in when accumulated oil in casing is produced and gas begins to break through from casing into the tubing, thus conserving the gas energy in the casing. Recently, the application to the flowing wells of flow intermitters, either pressure or time controlled, in order to better control and prevent excess loss of gas during break through period, has become a widespread practice.

Tests have shown a substantial decrease in gas-oil ratios and a steadier production with less down time when oil is flowed by intermitters. At all times, wells in the Richfield produce very near to full capacity and will not produce appreciably more oil if casing pressures are lowered by bleeding off casing gas.

Water Conditions. Brine production has not yet proved to be a major problem. The wells produce small quantities of brine—from ½ to 7 barrels daily. Richfield connate waters are highly saline approaching saturation with chlorides. The majority of the wells are treated at regular intervals with fresh water or a mixture of fresh and salt water to prevent salting off or tubing and to remove salt from the face of the formation.

The water is pumped or lubricated into the wells through the casing and allowed to remain on the bottom during intervals between flows, and is produced during the subsequent flow period. It also is necessary to hook the wells at frequent intervals to remove paraffin accumulation from the tubing.

Gas-Oil Ratios. Gas-oil ratios in the Richfield range from nearly natural dissolved gas-oil ratio of reservoir fluid, or approximately 800-900 cubic feet per barrel, to ratios in excess of 100,000 cubic feet of gas per barrel.

The Richfield crudes are saturated crudes at original reservoir pressures with from 775-850 cubic feet of dissolved gas per barrel. Rose City, St. Helen, Beaver Creek, and Norwich oil fields have gas caps in one or more of the pays in the structurally higher parts of the field. Some evidence that local gas caps occur outside the structurally higher areas has been found.

Reservoir Pressures. The exceptionally low permeability of the Richfield pay sections is evident immediately when wells are shut-in and allowed to build up to full static reservoir pressure. A very long shut-in period is required to attain static pressure even on relatively new wells showing higher initial pressure in the more permeable sections of the fields. Individual wells have reached near static pressure in 200-250 hours or from 9 to 10 days. One well was shut-in for five months and continued to build up pressure at the rate of

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System, Series	Formation, Group	Lithology	Thickness	Economic Products
RECENT				
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"Permo-Carboniferous"	"Red-Beds"	Shale, Clay, Sandy Shale, Gypsum	...	
Pennsylvanian	Grand River	Sandstone, Sandy Shale	80-95	Building Stone, Fresh Water
	Saginaw	Shale, Sandstone, Limestone, Coal	20-535	Shale, Coal, Fresh Water, Brine, Gas
Mississippian	Bay Port	Limestone, Sandy or Cherty Limestone, Sandstone	2-100	Limestone, Fresh Water
	Michigan	Shale, Gypsum, Anhydrite, Sandstone	0-500	Gypsum
	"Michigan Stray"	Sandstone	0-80	Gas
	Marshall	Sandstone, Sandy Shale	100-400	Fresh Water, Brine, Building Stone
	Coldwater	Shale, Sandstone, Limestone	500-1100	Shale, Fresh Water
	Sunbury	Shale	0-140	
	Berea-Bedford	Sandstone, Shale	0-325	Gas, Oil
	Ellsworth-Antrim	Shale, Limestone	100-950	Shale, Gas
Devonian	Traverse	Limestone, Shale	100-800	Limestone, Oil, Gas, Fresh Water
	Bell	Shale, Limestone	0-80	Shale
	Rogers City-Dundee	Limestone	0-475	Limestone, Oil, Gas, Fresh Water
	Detroit River Richfield	Dolomite, Limestone, Salt, Anhydrite	150-1400	Limestone, Dolomite, Oil, Gas, Salt, Brine, Fresh Water
	Sylvania	Sandstone, Sandy Dolomite	0-550	Glass Sand, Fresh Water
	Bois Blanc	Dolomite, Cherty Dolomite	0-1000	
Silurian	Bass Island	Dolomite	50-570	Dolomite, Fresh Water
	Salina	Salt, Dolomite, Shale, Anhydrite	50-4000	Salt, Gas, Oil
	Niagaran (Guelph-Lockport-Engadine) (Manistique-Burnt Bluff) (Cataract)	Dolomite, Limestone, Shale	150-800	Limestone, Dolomite, Oil, Gas, Fresh Water
Ordovician	Cincinnatian (Richmond) (Maysville-Eden)	Shale, Limestone	250-800	
	Trenton-Black River	Limestone, Dolomite	200-1000	Oil, Gas, Limestone, Fresh Water
	St. Peter	Sandstone	0-150	Fresh Water
Ozarkian Or Canadian	Prairie Du Chien	Dolomite, Shale	0-410	
	Hermansville	Dolomite, Sandy Dolomite, Sandstone	15-500	
Cambrian	Lake Superior (Munising) (Jacobsville)	Sandstone	500-2000	Building Stone Fresh Water
Algonkian	Keweenaw (Copper Formations)	Lava Flows, Conglomerate, Shale, Sandstone	9800-35000	Copper, Silver, Road Metal, Semi-Precious Gem Stones
	Killarney Granite	Granite, Gneiss, Diorite, Syenite		
	Huronian (Iron Formations)	Slates, Hematite, Schist, Quartzite, Granite, Marble, Dolomite	2000+	Iron Ore, Roofing Slate, Road Metal, Graphite, Marble
Archean	Laurentian	Schist, Gneiss, Granite		Road Metal, Building Stone, Verde Antique, Talc, Gold
	Keewatin	Schist, Greenstone, Slate		Road Metal

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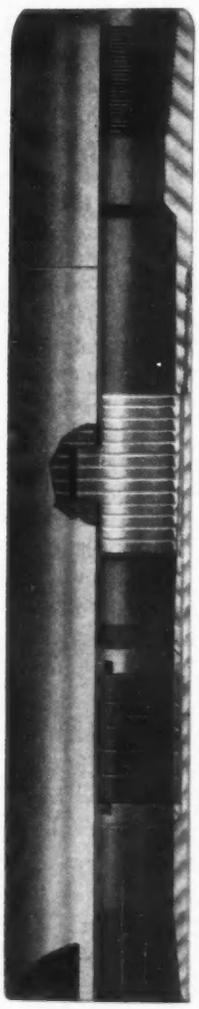

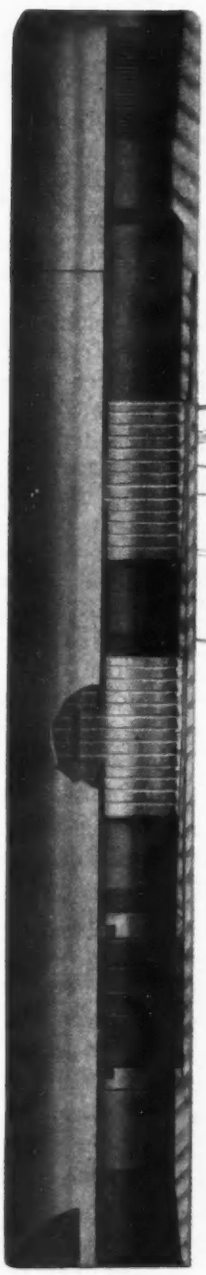

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approximately 100 pounds per month. Loss of revenue resulting from long shut-in periods has limited obtaining data on shut-in pressures to key wells and to shorter build-up periods of 100-110 hours. A program of 20-hour shut-in pressure surveys at six month intervals recently was adopted in several fields.

It is hoped that these surveys will show reservoir performance as well as indicate actual day to day operating bottom hole pressures. The history of the 20-hour pressure surveys will become more valuable with each additional survey. These surveys permit the operator to follow normal flow schedules and do not entail the loss of revenue associated with longer pressure build-up periods.

Brine production has been very small in the Richfield reservoirs and field performance data show the absence of an effective water drive.

Gas-Oil Ratios. All available reservoir and field performance data indicate a low order of recovery efficiency in the Richfield reservoirs. Since gas is the only source of energy for the producing mechanism, economic production of oil will cease when the supply of gas is exhausted or when pressure energy of gas is no longer capable of forcing fluids into the well bores.

Wells in the Richfield are drilled primarily for the production of oil. Any gas encountered in the oil-bearing strata is associated with oil and should be conserved and utilized for the efficient production of oil. No well should produce gas in excess of that minimum necessary to obtain its normal daily oil production. The efficiency with which a gas-drive is operated lies in the amount of stock tank oil produced per unit of net gas produced. The producing gas-oil ratio can thus be utilized to compare efficiency of various operating methods. The average field gas-oil ratio becomes a basic working tool for the engineer in analyzing reservoir performance.

The majority of the wells in the Richfield are unable to produce appreciably more fluids than shown in test work, as they are limited by the physical characteristics of the pays. Gas cap wells can produce gas with little or no oil on a 24-hour basis. These wells withdraw large quantities of fluid or gas energy from the reservoir at the expense of more efficient wells. The result of large free gas withdrawals is a major decrease in recovery efficiency.

Gas Conservation. The conservation of gas in gas-drive reservoirs has been a major problem in the industry for many years. The rapidly increasing cost of finding and developing new reserves throughout the nation is forcing attention on improved recovery methods. Need for some form of pressure maintenance in the Richfield reservoirs if recovery efficiency is to attain higher levels, is demonstrated. The large areal extent of the fields, the pay thickness, the present low recovery efficiency, the high cost of developing new reserves, the wide spacing pattern, and the increasing success and interest in pressure maintenance all are factors favoring the eventual adoption of fluid injection programs for the Richfield reservoirs.

In other states, the return of produced gas to the reservoirs has proved more workable under unitization plans. Field unitization has enabled engineers to produce the reservoirs under optimum conditions. Millions of barrels of additional oil now are being recovered under such plans. Feasibility and success of gas injection in the Richfield has been established by the pilot gas injection project in the East Norwich Field operated by the Sun Oil Company. Water injection has not yet been attempted, but is a future possibility.

The reserves in the Richfield are large, and recent discoveries, new extensions and development of proved areas will add rapidly to these reserves. An increasing percentage of Michigan's future petroleum production may be expected to come from the Richfield and deeper formations. Every new producing section presents new problems which are a challenge to the industry. The problems of the Richfield have presented one of the greatest challenges faced by the industry in Michigan to date. —**The End**

ACKNOWLEDGMENTS

The writer wishes to express his appreciation for the helpful criticism and assistance of Glenn Sleight, Ross Fugate and M. E. Austin of Sun Oil Company and to fellow members of the Geological Survey Staff, all of whom gave freely of their time, and without whose encouragement this article would not have been written.

Deltas Significant

Continued from Page 97

tion of the mapped area, shown in Figure 3, is strongly suggestive of localized sand thickening within this formation.

There are several genetically related and members in the McAlester formation known as the Booch sands. Locally these sands merge vertically into a single channel sand, as shown in Figure 2. The most widespread member is the Middle Booch sand. An isopach of these sands, shown in Figure 4, leaves little doubt of their deltaic character and origin. It may be noted that this large delta is confined to the shelf area along the northwest side of the McAlester Basin. Areas of no sand deposition are labeled, and the distributary nature of the thicker portions of the Booch is noteworthy. The channel sands range up to a maximum thickness of 240 feet. On most of the shelf area, between the line of flexure and the southern boundary of T13N, the Booch is sheet-like between the distributaries. Oil pools, shaded black, for the most part are limited to localized portions of the thinner channel sands. It is highly improbable that the Booch delta ever had as many distributaries during any one of its developmental stages as illustrated in Figure 4. This illustration represents a composite of all stages of delta distributary development. The source of the McAlester formation, with its Booch delta members, was to the northeast, in the direction of the Ozarks.

Figure 5 is a structure map of a productive portion of the Layton sand of a selected portion of the Mid-Continent Area. The contour lines, spaced at 20 foot intervals, are sinuous and exhibit numerous local convexities to the southwest. This sand was deposited in a pronounced structural trough with structural closure on the sand being conspiciously absent. The sand grades into shale to the west, east, and south. Such a map, when used alone, is of little value in defining the probable geographic extent of the pool and affords only a very incomplete picture of the probable nature (origin) of the sand.

—**End Part 1**

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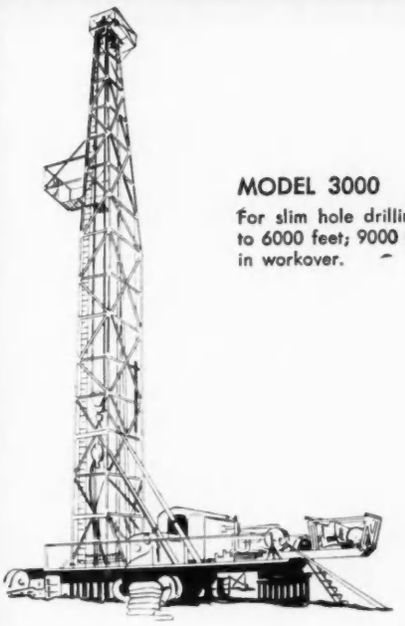

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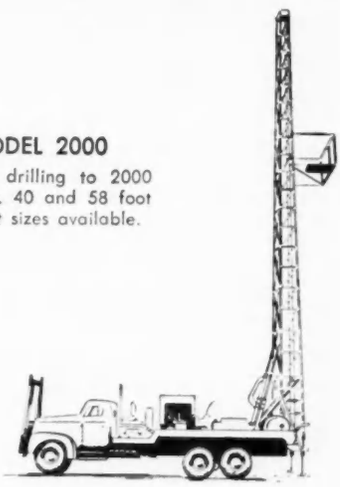

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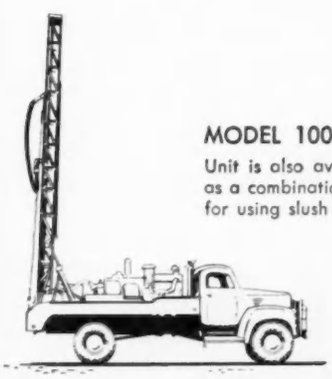

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What Industry Needs in Geologists

Requirements of oil companies in terms of trained manpower should be considered in shaping undergraduate curricula in geology departments of colleges.

MANY DEPARTMENTS of geology, especially those in the smaller colleges and universities, are constantly faced with the problem of placing their graduates in desirable positions in the geologic profession. Some educators maintain that this should be no problem in that the adequately trained student will be able to secure employment through his own efforts. However, departments which maintain poor records in regard to the employment of their graduates may expect decreased enrollments because most students regard college training as a means to obtain better positions than would be possible with only high school training. Therefore, consideration of the needs of industry in terms of trained manpower should be made by all persons concerned with establishing or revising the undergraduate curricula in the geology departments of our colleges and universities.

With this idea in mind a panel met at the Mississippi Academy of Science meeting in Jackson, Miss., in the spring of 1954 and discussed the training of geologists in regard to employment by the petroleum industry, the largest single outlet for geology students graduating from our colleges and universities. Members of this panel were R. B. Mattox, Department of Geology, Mississippi State College, chairman of the panel; A. E. Blanton, The Sun Oil Company, Jackson; O. T. Brown, Department of Geology, Mississippi Southern College; P. H. Dunn, Department of Geology, Mississippi State College; W. H. Knight, Union Producing Company, Jackson; R. R. Priddy, Department of Geology, Millsaps College; and H. N. Toler, consultant, Jackson. The views expressed below are those of a majority of the panel and do not necessarily reflect the views of any one member, unless such is specifically stated.

Q. *How many semester hours of geology and what specific courses should be required of all geology majors?*

A. Basic courses in physical geology, historical geology, mineralogy, paleontology, stratigraphy, structural geology, and field geology are regarded as the minimum training which should be required. The last requirement listed above, field geology, is intended to mean attendance at a summer field camp and not a course given on the campus during the regular academic year. Additional courses are regarded as desirable where the student's schedule permits, but no specific number of hours in geology is agreed upon. The average minimum requirement in 100 departments of geology in the United States is 37.26 semester hours of geology.

Q. *Of what value are courses in petroleum geology to students entering the petroleum industry?*

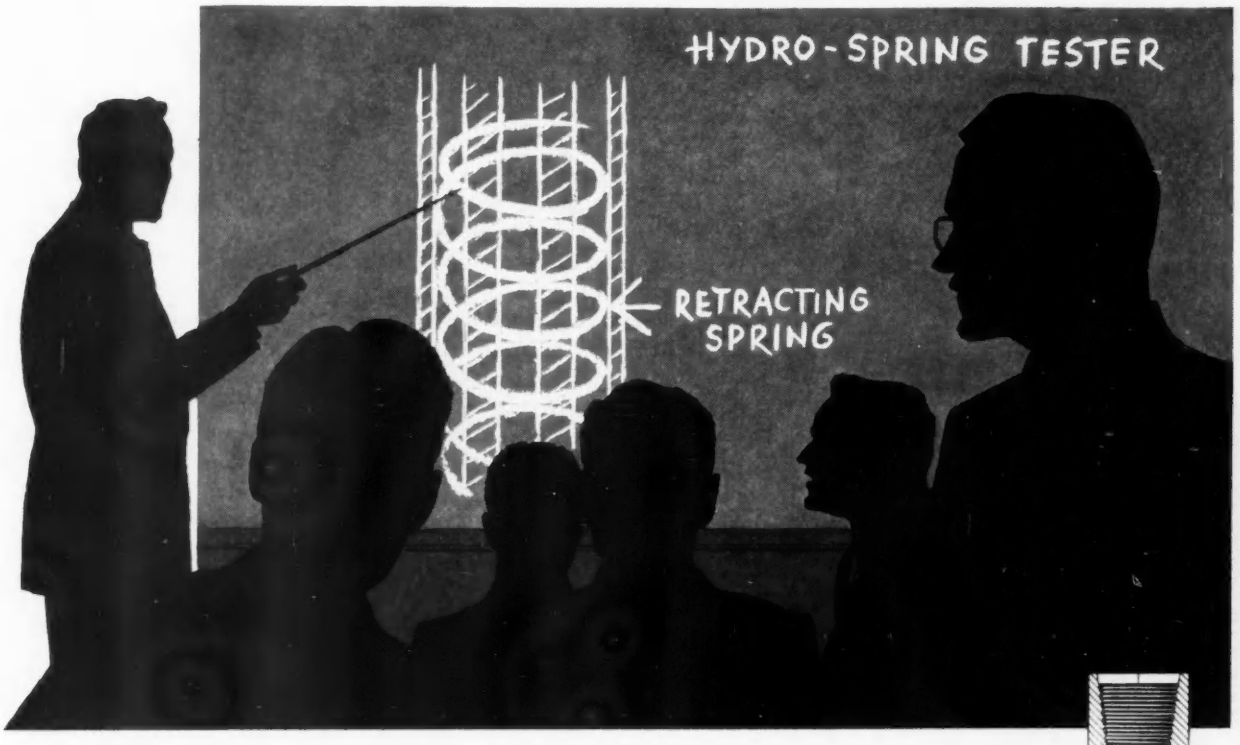
A. No agreement exists in regard to this question. Some members of the panel believe that all students should have some training in the theory and technology of petroleum geology whereas other members believe that courses in basic science are of more value. Many small departments do not have staff members who are familiar with the latest advancements in petroleum technology and, therefore, do not feel justified in offering courses in petroleum geology. However, if such training is essential to the student, steps should be taken to correct this deficiency in the teaching staff.

Q. *How much training in mathematics, chemistry, and physics should be required?*

A. A minimum of one year of training in each of the sciences listed above should be required. Additional training in any or all of these sciences is recommended. The greater part of the discussion centered on the need for calculus and the panel agrees that this training is not essential to most geologists. However, the writer (and chairman) would like to point out that many companies desire to see this course listed on the college transcript of an applicant. Therefore, most students will find that taking this training is to their advantage. The average minimum requirements in 100 departments of geology are as follows: mathematics, 7.88 semester hours; chemistry, 9.30 semester hours; and physics, 7.19 semester hours.

Q. *What are the advantages in taking graduate work?*

A. There are two distinct advantages in taking graduate work insofar as the student entering the petroleum industry is concerned: (1) such training increases his chances for obtaining employment; and (2) he usually receives a higher starting salary than a student with less academic training. Advancement with the company is largely dependent upon the quality of work and the employe's atti-



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tude rather than upon the academic degree he might possess.

Q. *What are the more common deficiencies noted in the academic training of young geologists now seeking employment in the petroleum industry?*

A. The inability to prepare acceptable written reports is noted as the most common deficiency. The geology departments can do some things to correct this situation but the greatest need is for better training in the fundamentals of grammar and spelling before the student enters college.

The task of drilling for oil requires that a geologist must expect to be called upon to spend long hours on wells without additional compensation. Many young geologists regard this as an imposition. Students who plan to major in geology and seek employment in the petroleum industry should be advised of this occupational "hazard" early and often during their academic training.

The writer would like to submit the suggestion that other organizations conduct similar panel discussions and submit the results for publication. Each passing year finds the task of discovering oil to be a bit more difficult than the previous one and demands better trained men to accomplish it. Although the training of petroleum geologists is not the sole function of the geology departments of the nation, a better understanding of the problems faced by the petroleum industry and the training desired of new employes could be of help to both the academic and industrial factions.

—The End

New Gulf Coast Map Service Available

A NEW MONTHLY wildcat map service has been initiated to show activity on the whole Gulf Coast of Louisiana, including offshore as well as land development. The maps are offered on a subscription basis by the Austin Oil & Gas Publishing Company, Box 5146, West Austin Station, Austin, Texas. Ted Wimberly is president of the company.

The Louisiana Gulf Coast is handled in two maps, covering the western and eastern sections of the region.

These Louisiana maps represent an extension of the service previously offered by the same company for the whole Gulf Coast of Texas. The Texas Gulf Coast is covered in three maps, embracing respectively the upper, central, and lower divisions of that region.

The Louisiana maps are on a scale of 1 inch equals 20,000 feet, and show sections, townships, and ranges in the land areas and blocks in the submerged areas. The maps show railroads, highways, and outlines of oil and gas fields, and salt domes, and in red all wildcats started, completed, or abandoned within 6 months preceding the date of a map. All wildcats carry identification through the month in which completed as producer or dry hole is noted, and after that the name is deleted, leaving the completion date, total depth or perforations for reference. New locations made during the month are circled in red, and new discoveries of the month are marked by a red arrow.

The Texas Gulf Coast wildcat maps are drawn on the scale of 1 inch equals 6000 varas (16,667 feet), and they show the counties, surveys, survey names, railroads, outlines of oil and gas fields and salt domes, and in red all wildcats started, completed, or abandoned within 12 months preceding the date of each map involved. All wildcats are identified until completed and then the name is taken off but completion date, total depth, or perforations are left for reference. New locations are circled in red, and new discoveries are marked by a red arrow.

Prices for the maps are as follows: Single issue of each map $4; three maps $10; five maps $15. Yearly subscriptions are discounted 10 percent. The price is further graduated downward for still larger numbers of subscriptions.

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Exploratory Drilling—In October and First Ten Months 1954-1953

State or District	MONTH OF OCTOBER, 1954													FIRST TEN MONTHS, 1954																	
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests									Total Productive		Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions										
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	10 Mo. 1954	10 Mo. 1953	Wildcats	New Pays	Outposts	10 Mo. 1954	10 Mo. 1953	10 Mo. 1954	10 Mo. 1953
Alabama											4			4												53			53	68	53	68
Arizona																										8			8	6	8	6
Arkansas				1			1			2	4			6	2		1	3		1	3			10	28	86			90	108	100	136
California	3		1							4	26		1	31	18		4	8		1	3		2	36	66	283		3	286	391	322	457
Colorado	2		2				1			5	62		6	73	38	4	14	2		1	3		1	63	38	448		14	462	243	525	281
Florida															1									1		24			24	29	25	29
Georgia											1			1												8			8	7	8	7
Idaho																										1			1	4	1	4
Illinois	3			3			7			13	57			70	22			28			52			102	69	491			491	394	593	463
Indiana											26			26	9		2							11	36	222			222	312	233	348
Kansas	9		3				1			13	51		9	73	93		23	4		1	5		1	127	141	623		10	633	753	760	894
Kentucky											6			6	21									21	21	44			44	94	65	115
Louisiana	4	1		6	5	1	5	1	7	30	32		5	67	28	21	14	41	35	10	10	3	9	171	110	317		19	336	333	507	443
North Louisiana	2			1			2	1	2	8	17		1	26	6	1	3	7	2	3	4	1	2	29	23	130		4	134	173	163	196
South Louisiana	2	1		5	5	1	3		5	22	15		4	41	22	20	11	34	33	7	6	2	7	142	87	187		15	202	160	344	247
Michigan	1									1	17			18	10						1			11	19	175			175	213	186	232
Mississippi	1									1	20			21	5		1					1		7	26	144		4	148	164	155	190
Missouri																										6			6	10	6	10
Montana	1						1			2	9			11	6		2	2			2			12	13	84			84	95	96	108
Nebraska	3									3	18		1	22	25		3	1			4			33	24	115		3	118	121	151	145
Nevada											1			1	1									1		10			10	8	11	8
New Mexico	3	1	5			1				10	9			19	17	1	35	5	2	2	6		1	69	67	135		1	136	120	205	187
North Carolina																														1	1
North Dakota	1			1						2	15			17	2			2			2			6	11	93			93	57	99	68
Ohio											1			1							3		4	7	5	12			12	12	19	17
Oklahoma	13		1	4			2		1	21	49		15	85	95	8	16	26	1	1	54	2	3	206	231	583		19	602	596	808	827
Pennsylvania											1			1											1				1		1	1
South Dakota											1			1	1											11			11	16	12	16
Tennessee																															1
Texas	28	2	4	31	4	1	14	2		86	232		7	385	442	66	75	215	49	20	97	13	14	991	952	3453		56	3509	3540	4500	4492
Dist. 1 S. Central	1			2						3	29		2	34	23	2	5	4	1	1	7	2	2	57	27	259		4	263	272	310	299
Dist. 2 Middle Gulf		1	1	2						4	20			24	5	12	12	6	3	3	3	1	2	47	63	225		4	229	228	276	291
Dist. 3 Upper Gulf	1			4	1			2		8	27		4	39	17	14	4	56	21	6	3	2	1	122	129	332		30	362	243	484	472
Dist. 4 L. Gulf-S.W.	1		1	5	2					9	31			40	20	21	4	46	18	4	2	6	2	123	161	307		7	314	413	437	574
Dist. 5 E. Central			1							1	7			8	2		1	1			1			5	8	117			117	95	122	103
Dist. 6 Northeast	1	1		1						3	10			13	3	4	1	3	2					13	19	134		2	136	125	149	144
Dist. 7-B N. Cent.	9			4			2			15	69			84	140	1	24	22			10		2	199	206	759		2	761	797	960	1003
Dist. 7-C W. Cent.	1			4			1			6	25			31	42	4	9	19	1	2	9		2	82	80	301		3	304	298	386	378
Dist. 8 West	6			4	1	1	5			17	10			27	80	2	3	32	2	3	44	1	1	168	109	316		2	318	314	486	423
Dist. 9 North	7			4			6			17	58		1	76	105	4	4	30		1	18		1	163	147	651		2	653	648	816	795
Dist. 10 Panhandle	1		1	1						3	6			9	5	2	8	2	1	1	1	1	1	22	3	52			52	7	74	10
Utah											7			7	2			2						4	12	34			34	37	38	49
West Virginia											1			1												2			2		2	
Wyoming	1						2			3	22			25	51		5	7	1	1	5			70	31	175			175	104	245	135
Total U.S.	73	4	16	46	9	3	34	3	8	196	732		44	972	889	100	197	344	88	38	250	19	35	1960	1901	7641		133	7774	7837	9734	9738

Wildcats on Par with 1953 Record

9734 completions in first ten months a scant 0.1 percent less than last year.

By CECIL W. SMITH, WORLD OIL Staff

THERE HAS BEEN very little difference in volume of wildcat drilling this year compared to last year's record-breaking exploratory activity, and at the end of ten months the scant margin of four completed tests separated the two periods. At the end of October, the slight advantage belonged to the 1953 operations.

This year, a total of 9734 exploratory wells were completed in the U. S. and that was four wells or 0.1 percent less than the 9738 recorded in the same period a year ago. However, this year has the edge in the number of successful tests. So far, 1960 have been commercial wells for a score of 20.1 percent of the total drilled, while a year before, 1901 successes accounted for 19.5 percent.

Part of the results of current exploration has been the opening of 1233 new oil pools, which consisted of 889 new oil fields and 344 new oil pays in existing fields. A year before, the count had been 1187 new oil pools.

New distillate pools have numbered 188 this year, 100 new fields and 88 new horizons in older areas. Last year, comparable results were 131 pools, 79 fields and 52 new pays.

Natural gas discoveries have totaled 235 this year, which was only two more than the 233 chalked up in 1953. This year's finds consisted of 197 fields and 38 new pools in old fields.

Summary of Results of Exploratory Drilling

ITEM	Oct., 1954	Sept., 1954	TEN MONTHS January-October 1954	1953	Percent Diff.
Oil Discoveries	119	127	1233	1187	+ 3.9
New Fields	73	90	889	869	+ 2.3
New Pays	46	37	344	318	+ 8.2
Distillate Discoveries	13	23	188	131	+43.5
New Fields	4	14	100	79	+26.6
New Pays	9	9	88	52	+69.2
Gas Discoveries	19	25	235	233	+ 0.9
New Fields	16	18	197	192	+ 2.6
New Pays	3	7	38	41	— 7.3
Total Discoveries	151	175	1656	1551	+ 6.8
Extension to Fields	45	34	304	350	—13.2
Oil Fields	34	29	250	281	—11.0
Distillate Fields	3	1	19	25	—24.0
Gas Fields	8	4	35	44	—20.5
Total Prod. Tests	196	209	1960	1901	+ 3.1
Dry Holes	776	830	7774	7837	— 0.8
Wildcats	732	816	7641	7710	— 0.9
New Pays				1	
Outposts	44	14	133	126	+ 5.6
Total Expl'tory Tests	972	1039	9734	9738	— 0.1
Percent Productive	20.2	20.1	20.1	19.5	
Percent Dry	79.8	79.9	79.9	80.5	

Merry Christmas

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DALLAS, TEXAS

U. S. Discoveries in October

NEW FIELDS, NEW PAYS AND EXTENSIONS

ARKANSAS—NEW OIL PAY

Union County, Hillsboro, South field. Pan Am Southern Corp. & Olin O&G Corp.'s Olin 2, C SE SE SE 26-18s-14w, Old Well Worked Over, flowed 131 barrels from Glen Rose sand, Lower Cretaceous 3462-64 feet, 12/64-inch, completed 8-15-54, TD 4507.

ARKANSAS—OIL FIELD EXTENSION

Union County, Schuler field. W. H. Sewell's Cottrell 1, C NW SE NE 23-18s-17w, ⅝-mile southwest extension, flowed 65 barrels from Petit lime, Lower Cretaceous 3986-92 feet, ¼-inch, 42-gravity, completed 10-13-54, TD 4027.

CALIFORNIA—NEW OIL FIELDS

Fresno County. Intex Oil Co.'s Benadom 26-29, in 29-17s-19e, pumped 25 barrels oil and 30 barrels water from Nortonville sand, Eocene 8300-20 feet, 33-gravity, completed 10-15-54, TD 8666.

Orange County. Monterey Oil Co.'s Monterey-Texas-State 3, in 22-5s-12w, flowed 300 barrels, 30/64-inch, 26.4-gravity, completed 10-1-54, TD 10,162.

San Benito, Ciervo Anticline area. Cedar Flat Oil Co.'s Ashurst 2, in 27-16s-11e, pumped 15 barrels from San Carlos sand, 995-1005 and 1015-40 feet, 30.1 gravity, completed 10-15-54, TD 1215.

CALIFORNIA—NEW GAS FIELD

Sacramento County, Georgiana Slough area. The Texas Co.'s Georgiana Unit 1, in 10-4n-4e, flowed 1.7 million from Upper Domengine sand, Eocene 3494-95 and 3540-55 feet, ¼-inch, completed 10-5-54, TD 4300.

COLORADO—NEW OIL FIELDS

Morgan County, Park field. British-American Oil Producing Co.'s Hegarty 1, C NW SE 26-1n-59w, pumped 121 barrels from "J" sand, Upper Cretaceous 6205-15 feet, completed 10-15-54, TD 6302.

Morgan County. J. A. LaFortune's Knight 1, SE SE NW 34-2n-55w, pumped 12 barrels from "D" sand, Upper Cretaceous 4933-34 feet, 38-gravity, completed 10-6-54, TD 5099.

COLORADO—NEW GAS FIELDS

Archuleta County. Standolind O&G Co.'s Bixler Gas Unit 1, C W½ NE SW 14-32n-6w, flowed 0.3 million from Fruitland sand, Upper Cretaceous 2518-62, 2590-2640 and 2665-75 feet, completed 9-30-54, TD 5332.

Morgan County. Sanford Production Co., Inc.'s Atkinson 1, SW SW SW 10-2n-55w, flowed 5.5 million from "D" sand, Upper Cretaceous 4955-58 feet, open, completed 10-30-54, TD 5061.

COLORADO—OIL FIELD EXTENSION

Logan County, Dune Ridge field. Shell Oil Co.'s State 688-7, C NW SW 32-7n-52w, pumped 115 barrels from "D" sand, Upper Cretaceous 4458-73 feet, completed 10-25-54, TD 4473.

ILLINOIS—NEW OIL FIELDS

Christian County, Edinburg, West field. Arnold Valter's S. Driskill 1, NE NE SE 17-14n-3w, pumped 164 barrels oil and 13 barrels water from Hardin sand, Mississippian-Devonian and Silurian lime 1663-69 and 1682-93 feet, completed 10-26-54, TD 1694.

Randolph County, Baldwin field. Jet Oil Co.'s Rodgers 2, NE NE SW 7-4s-6w, pumped 4 barrels oil and 1 barrel water from Silurian lime, 1536 feet, completed 10-2-54, TD 1850.

Saline County, Eldorado, North field. Calvert Drilling Co.'s Endicott 1, NW SW SE 2-8s-7e, pumped 65 barrels from Waltersburg sand, Mississippian 2117-22 feet, completed 10-5-54, TD 3050.

ILLINOIS—NEW OIL PAYS

Gallatin County, Junction field. N. V. Duncan's School Trustees 1, NE NE SW 16-9s-9e, pumped 67 barrels from Cypress sand, Mississippian 2274-86 feet, completed 10-5-54, TD 2675.

White County, Carmi field. Arrow Drilling Co.'s Brown 1, SE SE NE 34-5s-9e, pumped 6 barrels from Pennsylvanian sand 1208-20 feet, completed 10-26-54, TD 3302.

White County, Norris City field. T. Whittington's Delap Community 1, SE SW NW 33-6s-8e, pumped 120 barrels oil and 36 barrels water from Cypress sand, Mississippian 2674-84 feet, completed 10-6-54, TD 3160.

ILLINOIS—OIL FIELD EXTENSIONS

Christian County, Blackland field. Nieman & Anderson's McVey 1, SE NE SE 2-15n-1w, 1-mile west extension, pumped 137 barrels from Silurian lime, 1898-1910 feet, completed 10-2-54, TD 1918.

Christian County, Edinburg, West field. Keysone Oil Co.'s Gray-Herndon 1, NE SE NW 17-14n-3w, ½-mile northwest extension, pumped 30 barrels from Silurian lime, 1727-29 feet, completed 10-5-54, TD 2285.

Edwards County, Ellery, North field. Noah Petroleum Co.'s C. Johnson 1, NE NE SW 18-2s-10e, ½-mile extension, pumped 25 barrels from Rosiclare lime, Mississippian 3338-45 feet, completed 10-5-54, TD 3380.

Gallatin County, Roland Consolidated field. Murvin & Steber's F. J. Johnson 1, NE NW SE 24-7s-8e, Old Well Worked Over, ½-mile extension, flowed 520 barrels from Bethel sand, Mississippian 2712-32 feet, completed 10-12-54, TD 2900.

Jasper County, Clay City Consolidated field. Skiles Oil Co.'s Ochs 1, NE NE SW 28-7n-10e, 1-mile extension, pumped 24 barrels oil and 15 barrels water from Rosiclare lime, Mississippian 2773-82 feet, completed 10-2-54, TD 2853.

White County, Concord field. E. F. Moran's B. Watkins 1, SE NW NE 16-6s-10e, ½-mile north extension, pumped 29 barrels from Cypress sand, Mississippian 2655-72 feet, completed 10-19-54, TD 3083.

White County, Epworth Consolidated field. Eastern Petroleum Co.'s C. Rice 1, SE NW SW 22-5s-10e, 1-mile northeast extension, pumped 55 barrels oil and 100 barrels water from Clore shale, Mississippian 2085-2105 feet and Palestine sand, Mississippian 2153-66 feet, completed 10-12-54, TD 3122.

KANSAS—NEW OIL FIELDS

Barber County, Salt Fork field. The Chicago Corp's. Davis Ranch 1, C NE NE 11-35s-15w, flowed 32 barrels from Miscago Corp.s' Davis Ranch 1, C NE NE sissippi lime, Mississippian 4982-5003 feet, TD 5777.

Ellis County, Younger, South field. Transit Corp. & Davis Brothers' Lang 1-T, NE SE NW 8-14s-17w, pumped 125 barrels from Arbuckle lime, Ordovician 3547-53 feet, TD 3553.

Ellis County. Veeder Supply Co.'s Irwin 1, NW NW NW 11-11s-20w, potentialed 1961 barrels from Lansing lime, Pennsylvanian 3368-74 feet, TD 3651.

Graham County, Noah, Southwest field. Petroleum, Inc.'s Noah 1, NW SE NW 33-10s-21w, pumped 130 barrels from Marmaton lime, Pennsylvanian 3756-64 feet, TD 3830.

Graham County, Sand Creek field. Schermerhorn Oil Corp.'s Newell 1, SE NW NW 27-8s-21w, pumped 166 barrels from Lansing lime, Pennsylvanian 3387-93 feet, TD 3690.

Marion County. Anderson-Prichard Oil Corp.'s Hett 1, SW NE SW 3-19s-2e, pumped 43 barrels from Simpson sand, Ordovician 3039-41 feet, TD 3130.

Rooks County. United Drilling Co.'s Folke 1, NE SE SE 18-10s-19w, pumped 213 barrels from Arbuckle lime, Ordovician 3770-78 feet, TD 3782.

Sedgwick County, Gladys field. Beardmore Drilling Co. et al's Tyson 1, NE SE SW 30-28s-1e, pumped 123 barrels from Mississippi lime, Mississippian 3171-85 feet, TD 3186.

Stafford County, Cephas, North field. Deep Rock Oil Corp.'s Bowker 1, NE SW SW 35-24s-14w, pumped 135 barrels from Lansing lime, Pennsylvanian 3794-3803 feet, TD 4283.

KANSAS—NEW GAS FIELDS

Barber County, Meas field. Aylward & Orville Parker's Meas 1, NE NE SW 27-30s-11w, flowed 5.0 million from Douglas sand, Pennsylvanian 3759-69 feet, open, TD 3769.

Barber County, Whelan, East field. Orville Parker's Chain 1, SE SE SE 21-31s-11w, flowed 2.4 million from Douglas sand, Pennsylvanian 3749-4489 feet, open, TD 4530.

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INDUSTRIAL GASOLINE ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.2 @ 2200 RPM
N62	4	2⅜	3½	62	15 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3 3/16	3½	112	32 @ 2400 RPM
F124	4	3	4⅜	124	36 @ 2400 RPM
F140	4	3 3/16	4⅜	140	42 @ 2400 RPM
F162	4	3 7/16	4⅜	162	49 @ 2400 RPM
F186	6	3	4⅜	186	60.5 @ 2400 RPM
*E201	4	3⅝	4⅞	201	59 @ 2000 RPM
F209	6	3 3/16	4⅜	209	68 @ 2400 RPM
F226	6	3 5/16	4⅜	226	73 @ 2400 RPM
F244	6	3 7/16	4⅜	244	79 @ 2400 RPM
M271	6	3⅝	4⅜	271	86.2 @ 2400 RPM
M290	6	3¾	4⅜	290	92.2 @ 2400 RPM
M330	6	4	4⅜	330	104.4 @ 2400 RPM
M363	6	4	4 13/16	363	109 @ 2000 RPM
B371	6	4⅛	4⅝	371	110 @ 2400 RPM
B427	6	4 5/16	4⅞	427	127 @ 2400 RPM
G134	4	3⅛	4⅜	134	32.2 @ 2000 RPM
G157	4	3⅜	4⅜	157	37.7 @ 2000 RPM
H227	4	3⅝	5½	227	52 @ 1800 RPM
H243	4	3¾	5½	243	56 @ 1800 RPM
*H260	4	3⅞	5½	260	60 @ 1800 RPM
T371	6	4⅛	4⅝	371	119 @ 2400 RPM
*J382	4	4½	6	382	74.2 @ 1400 RPM
T427	6	4 5/16	4⅞	427	140 @ 2400 RPM
U501	6	4½	5¼	501	160 @ 2400 RPM
R513	6	4½	5⅜	513	164.3 @ 2400 RPM
R572	6	4¾	5⅜	572	182.4 @ 2400 RPM
R602	6	4⅞	5⅜	602	191.7 @ 2400 RPM
S749	6	5⅜	5½	749	217 @ 2200 RPM
S820	6	5⅝	5½	820	237 @ 2200 RPM

INDUSTRIAL DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
GD157	4	3⅜	4⅜	157	39 @ 2000 RPM
*ED201	4	3⅝	4⅞	201	45.8 @ 2000 RPM
HD243	4	3¾	5½	243	54.7 @ 2000 RPM
*HD260	4	3⅞	5½	260	59.3 @ 2000 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 5/16	4⅞	427	106.5 @ 2000 RPM
RD572	6	4¾	5⅜	572	142.5 @ 2000 RPM
SD802	6	5 5/16	5½	802	202 @ 1800 RPM

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Clark County. Sinclair O&G Co.'s Laura Combrink 1, C NW SE 22-33s-21w, flowed 8.0 million from Morrow sand, Mississippian 5318-60 feet, open, TD 5463.

KANSAS—OIL FIELD EXTENSION

Stafford County, Kipp field. Deep Rock's Tanner 1, NE SW NW 23-25s-14w, pumped 208 barrels from Lansing lime, Pennsylvanian 3748-58 feet, TD 4326.

NORTH LOUISIANA—NEW OIL FIELDS

Bienville Parish, Cypress Springs field. Pure Oil Co.'s J. B. Smith Unit 1, NW 35-17n-7w, flowed 238 barrels from Pettit sand, Lower Cretaceous 7022-40 feet, 20/64-inch, 38.5-gravity, completed 10-21-54, TD 7102.

La Salie Parish. Nebo Oil Co., Inc.'s Nebo Fee 12, in 13-8n-1e, flowed 24 barrels oil and 97 barrels water from Wilcox sand, Eocene 3484-94 feet, 16/64-inch, completed 10-2-54, TD 4213.

NORTH LOUISIANA—NEW OIL PAY

Claiborne Parish, Colquitt field. Lion Oil Co.'s Greer 1, in 34-23n-6w, flowed 326 barrels oil and 17 barrels water from Taylor sand, Upper Cretaceous 8949-66 feet, ⅜-inch, 58-gravity, completed 10-2-54, TD 10,800.

NORTH LOUISIANA—OIL FIELD EXTENSIONS

Concordia Parish, Bee Brake field. David Crow, Trustee's Quinn 1, NW SE 24-4n-6e, ¾-mile southwest extension, pumped 113 barrels from Wilcox sand, Eocene 6721-24 feet, 36-6-gravity, completed 10-1-54, TD 6776.

Concordia Parish, Bee Brake field. E. C. Wentworth & Como Drilling Co.'s Crothers 1, C NW NW 16-4n-7e, ¾-mile northeast extension, flowed 60 barrels from Wilcox sand, Eocene 6754-58 and 6760-66 feet, open, 41.5-gravity, completed 9-30-54, TD 6808.

NORTH LOUISIANA—DISTILLATE FIELD EXTENSIONS

DeSoto Parish, Bethany-Longstreet field. Jack W. Grigsby's Schuler Estate 1, in 10-13n-15w, 2⅛-mile southeast extension, flowed ungaged distillate and 32.5-million from Pettit sand, Lower Cretaceous 6505-13 feet, open, 54-gravity, completed 10-7-54, TD 7047.

NORTH LOUISIANA—GAS FIELD EXTENSIONS

Bienville Parish, Ada field. Atlantic Refining Co.'s W. L. Hammer 1, in 5-17n-7w, 1-mile east extension, flowed 14 barrels distillate and 1.8 million from Travis Peak sand, Lower Cretaceous 6980-88 feet, and 10 barrels distillate and 1.7 million from Travis Peak, 7286-98 feet, ¼-inch, completed 10-28-54, TD 7586.

Richland Parish, Delhi field. M. F. McCain & J. E. Marshall's Donnell 1, in 24-17n-8e, ½-mile north extension, flowed 5.5 million from Glen Rose sand, Lower Cretaceous 3097-3103 feet, ½-inch, completed 10-14-54, TD 3201.

SOUTH LOUISIANA—NEW OIL FIELDS

Jefferson Parish, Manila Village area. Humble O&R Co.'s LL&E 1-S, in 18s-24e, flowed 81 barrels from 11,738-745 feet, ⅛-inch, 35.8-gravity, completed 10-9-54, TD 12,956.

Plaquemines Parish, South Pass area. Shell Oil Co.'s State Lease 1012-1, Block 28, Gulf of Mexico, flowed 215 barrels oil and 16 barrels water from 7364-72 feet, 10/64-inch, 31.9-gravity, completed 10-1-54, TD 8576.

SOUTH LOUISIANA—NEW DISTILLATE FIELD

St. Martin Parish. Humble's R. H. Goodrich et al J-1, in 33-14e-12e, flowed 48 barrels distillate and 3.1 million from 12,584-590 feet, 3/16-inch, 52-gravity, completed 10-25-54, TD 13,053.

SOUTH LOUISIANA—NEW OIL PAYS

Iberville Parish, Laurel Ridge field. F. A. Callery, Inc.'s Canal Assets, Inc. 1, in 69-10s-14e, flowed 216 barrels from Lower Miocene sand, 10,109-113 feet, ⅛-inch, 35.2-gravity, completed 10-15-54, TD 10,730.

Jefferson Parish, ManilaVillage field. Tide Water Associated Oil Co.'s State Lease 1299-1, in 35-18s-24e, Old Well Worked Over, flowed 97 barrels oil and 146 barrels water from 12,090-096, 12/64-inch, 27.2-gravity, completed 9-13-54, TD 13,050.

La Fourche Parish, Bay Marchand-Block 2. The California Co.'s State Lease 1367 I-10, Gulf of Mexico, Flowed 171 barrels oil and 114 barrels water from Upper Miocene sand, 3284-3304 feet, 32/64-inch, 22-gravity, completed 10-24-54, TD 4136.

Plaquemines Parish, West Delta-Block 30. Humble's Humble-Shell State Lease 820-E-1, Block 31, Gulf of Mexico, flowed 229 barrels from Upper Miocene sand, 10,240-250 feet, ⅛-inch, 22.9-gravity, completed 10-21-54, TD 11,141.

St. Mary Parish, Eugene Island-Block 126. Magnolia Petroleum Co.'s State Lease 691-F-5, Gulf of Mexico, flowed 297 barrels from Upper Miocene sand, 7535-45 feet, 9/64-inch, 34.8-gravity, completed 10-25-54, TD 9450.

SOUTH LOUISIANA—NEW DISTILLATE PAYS

Acadia Parish, Church Point field. Tide Water's Theodore R. Daigle 1, in 83-8s-2e, flowed 135 barrels distillate and 2.7 million from Lower Miocene sand, 12,408-414 feet, 10/64-inch, 40.7-gravity, completed 10-3-54, TD 14,016.

Acadia Parish, Crowley, North field. Humble's H. J. Habertz et al 8, 45-8s-1e, flowed 24 barrels distillate and 1.6 million from Lower Miocene sand, 11,040-054 feet, 8/64-inch, 55.4-gravity, completed 10-16-54, TD 12,477.

Cameron Parish, East Cameron-Block 71. Continental Oil Co.'s State Lease 1208-A-1, Gulf of Mexico, flowed 53 barrels distillate and 3.5 million from 8066-80 feet, 16/64-inch, completed 10-16-54, TD 9750.

Lafayette Parish, Duson field. Sunray Oil Corp.'s Mary E. McConnell 3, in 8-10s-3e, flowed 50 barrels distillate and 2.8 million from Lower Miocene sand, 11,058-068 feet, 8/64-inch, 45-gravity, completed 10-22-54, TD 11,600.

Plaquemines Parish, Washington field. J. W. Mecom & Freeport Sulphur's LL&E 1, in 31-19s-27e, flowed 415 barrels distillate and 0.9 million from 15,131-138 feet, 9/64-inch, 45.3-gravity, completed 10-13-54, TD 16,281.

SOUTH LOUISIANA—NEW GAS PAY

Jefferson Davis Parish, Lake Arthur field. Union Sulphur & Oil Co.'s T. R. S. Farms Co., Inc. 10, in 14-10s-4w, ungaged gas from Lower Miocene sand, 10,078-086 feet, completed 10-9-54, TD 14,400.

SOUTH LOUISIANA—OIL FIELD EXTENSIONS

Assumption Parish, East Lake Palourde field. Union Oil Co. of Calif's Williams, Inc. 3, in 30-15s-14e, ½-mile southeast extension, flowed 310 barrels from 13,409-414 feet, 8/64-inch, 37.9-gravity, completed 10-24-54, TD 13,503.

Terrebonne Parish, Halter Island field. Shell Oil Co.'s State Lease 2077-6, ¾-mile south extension, flowed 195 barrels from Upper Miocene sand, 10,714-717 feet, 6/64-inch, 39.5-gravity, completed 10-22-54, TD 10,769.

Terrebonne Parish, Lake Hatch field. Union Oil Co. of Calif's LL&E 15-B, in 4-18s-16e, 1¼-mile northeast extension, flowed 150 barrels from Upper Miocene sand, 7755-65 feet, 9/64-inch, 35.1-gravity, completed 10-2-54, TD 8475.

SOUTH LOUISIANA—GAS FIELD EXTENSIONS

Cameron Parish, Grand Chenier field. Fifteen Oil Co.'s C. & J. Nunez 2, in 13-15s-5w, ½-mile east extension, flowed ungaged gas from Lower Miocene sand, 11,210-220 feet, completed 10-30-54, TD 12,024.

Cameron Parish, Thornwell, South field. Pan American Production Co. & Austral Oil Exploration Co.'s The Lacassine Co., Inc. 1, in 1-12s-5w, ¾-mile west extension, flowed ungaged gas from 9632-48 feet, completed 10-10-54, TD 15,075.

La Fourche Parish, Bully Camp field. Texas Crude Oil Co.-Rebstock & Reeves' Sylvester Argeron 1, in 5-18s-21e, 1½-mile northeast extension, ungaged gas from Upper Miocene sand, 10,880-901 feet, completed 9-18-54, TD 11,204.

St. Landry Parish, Washington field. Sohio & Gulf's Thistlewaite Lumber Co. 14, in 5-5s-5e, ¾-mile southeast extension, ungaged gas from Claiborne sand, Eocene 9435-54 feet, completed 10-19-54, TD 9515.

Terrebonne Parish, Hollywood field. Union Producing Co.'s Allan Land Co., Inc. 1, in 96-17s-17e, 2-mile northeast extension, ungaged gas from Upper Miocene sand, 10,065-71 feet, completed 10-24-54, TD 12,850.

MICHIGAN—NEW OIL FIELD

Missaukee County. Union Development Co.'s Merrill-Palmer School 1, S ½ NW SE 35-22n-6w, flowed 42 barrels from Richfield sand, 5145-49 feet, TD 5254.

MISSISSIPPI—NEW OIL FIELD

Wilkinson County, Mills Bayou field. Serio-Punches & Como Drilling Co.'s Pettis 1, in 25-4n-3w, flowed 130 barrels from Wilcox (Pettis) sand, Eocene 6379-82 feet, ⅛-inch, 38-gravity, completed 10-15-54, TD 7210.

MONTANA—NEW OIL FIELD

Wibaux County. Lion Oil Co.'s Knight 1, C SW NW 29-14n-60e, pumped 118 barrels from Red River sand, Ordovician 11,099-119 feet, 33-gravity, completed 4-28-54, TD 11,153.

MONTANA—OIL FIELD EXTENSION

Carbon County, Clarks Fork field. J. Ray McDermott's Unit 1, SE SW NW 27-9s-22e, flowed 248 barrels from Basal

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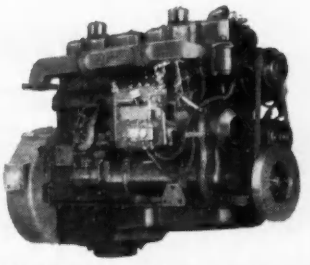

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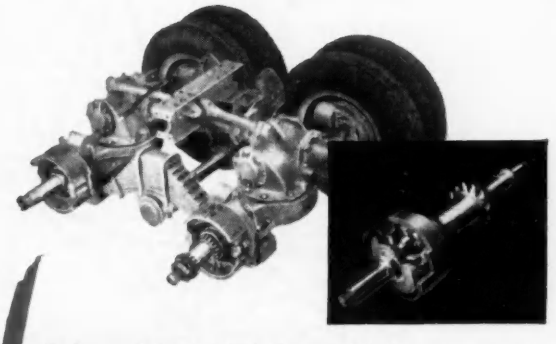

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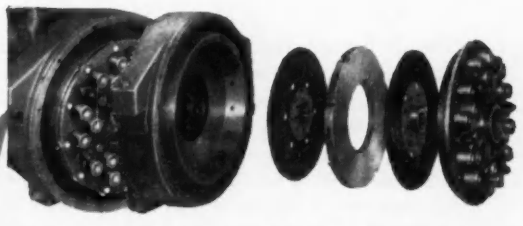

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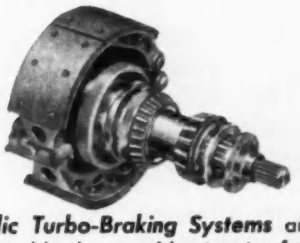

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Frontier sand, Upper Cretaceous 6716-31 and 6736-49 feet, ¼-inch, 43-gravity, completed 10-7-54, TD 8030.

NEBRASKA—NEW OIL FIELDS

Cheyenne County. Gem Oil Co.'s Woten 1, NE NE NW 29-16n-52w, pumped 140 barrels from "J" sand, Upper Cretaceous 5455-58 feet, completed 10-2-54, TD 5489.

Cheyenne County. Ryan Oil Co.'s & Davis Oil Co.'s Ittner 1, NW NW NW 9-15n-52w, pumped 400 barrels from "J" sand, Upper Cretaceous 5384-94 feet, completed 10-2-54, TD 5441.

Kimball County, Leonard field. Don M. Rounds et al's Annie K. Leonard 1, NW NW NW 7-12n-55w, pumped 125 barrels from "J" sand, Upper Cretaceous 6479-86 feet, completed 10-9-54, TD 6510.

NEW MEXICO—NEW OIL FIELDS

Eddy County. The Ibex Oil Co.'s Hanson-Federal 1, in 25-26s-31e, flowed 44 barrels from Delaware sand, Permian 4139-47 feet, ¼-inch, 42.2-gravity, completed 9-18-54, TD 4147.

Eddy County. Richardson & Bass' Julia Beeman 1, in 2-24s-28e, Old Well Worked Over, pumped 25 barrels oil and 18 barrels water from Delaware sand, Permian 4678-8153 feet, 34.2-gravity, completed 10-8-54, TD 8153.

Eddy County. Simms & Reese's McClay 1, in 33-18s-30e, Old Well Worked Over, flowed 100 barrels from Queen sand, Permian 2844-67 feet, open, 36-gravity, completed 9-1-54, TD 3556.

NEW MEXICO—NEW DISTILLATE FIELD

Rio Arriba County. Humble's Jicarilla 1, NW NW 15-23n-5w, flowed 10 barrels distillate and 0.9 million from Dakota sand, Upper Cretaceous 6663-75 feet, ⅜-inch, 60-gravity, completed 10-18-54, TD 7658.

NEW MEXICO—NEW GAS FIELDS

Rio Arriba County. Magnolia's Henry Schmitz 1, NE SE 34-24n-1w, flowed 2.4 million from Torrejon-Puerco sand, Eocene 2715-25 feet, open, completed 10-19-54, TD 8930.

Rio Arriba County. Southern Union Gas Co.'s Jicarilla 1-F, SE NW SW 27-26n-4w, Old Well Drilled Deeper, flowed 0.4 million from Mesaverde sand, Upper Cretaceous 5419-6083 feet, completed 10-18-54, TD 6083.

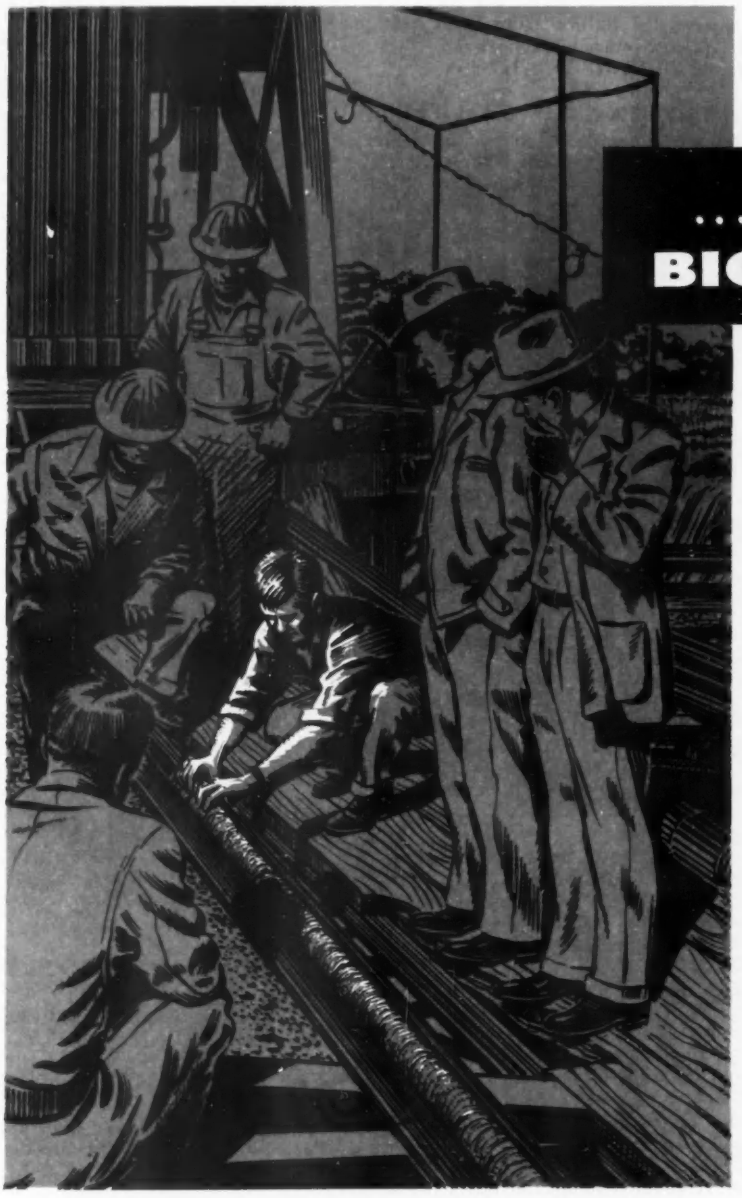
San Juan County. El Paso Natural Gas Co.'s Allison 7, NW SE SE 10-32n-7w, flowed 4.4 million from Dakota sand, Upper Cretaceous 8179-8443 feet, completed 10-21-54, TD 8443.

San Juan County. Skelly Oil Co.'s Navajo 1-B, SW NE NE 14-26n-12w, flowed 3.5 million from Hospah sand, Upper Cretaceous 5010-50 feet, completed 10-2-54, TD 7134.

San Juan County. Southern Union Gas Co.'s Starr 1, SW NE NE 6-26n-8w, Old Well Drilled Deeper, flowed 1.6 million from Pictured Cliffs sand, Upper Cretaceous 1975-2076 feet, completed 10-18-54, TD 2076.

NEW MEXICO—NEW GAS PAY

San Juan County, Blanco field. McMillan-White's Omler 1, SE NW SW 36-28n-



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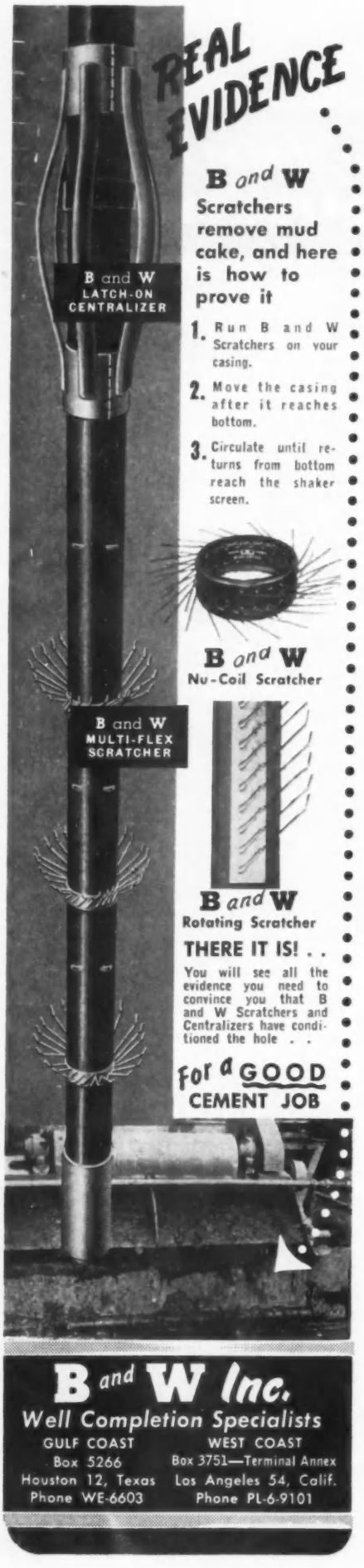
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10w, flowed 0.7 million from Fruitland sand, Upper Cretaceous 1060-1112 feet, completed 10-12-54, TD 1112.

NORTH DAKOTA—NEW OIL FIELD

Stark County. Amerada Petroleum Corp.'s Roger E. Newton 1, C NW SW 3-140n-99w, flowed 21 barrels oil and 5 barrels water from Heath sand, Mississippian 8249-54 feet, 2-inch, 31.2-gravity, completed 9-20-54, TD 9577.

NORTH DAKOTA—NEW OIL PAY

Williams County, McGregor field. Western Nodana Corp. & Paul F. Rutledge's Oscar E. Westberg 1, C NW NW 31-159n-95w, flowed 426 barrels from Madison sand, Mississippian 8135-46 feet, ¼-inch, 40-gravity, completed 10-5-54, TD 8146.

OKLAHOMA—NEW OIL FIELDS

Garfield County. Frank G. Weimer & John R. Fitzhugh's Edwin L. Baker 1, NW NE NW 13-22n-3w, flowed 207 barrels from 2nd Wilcox sand, Ordovician 5476-80 feet, 15/64-inch, 39.7-gravity, TD 5550.

Grady County. E. J. McCurdy, Jr. & E. R. Bahan's J. H. Bowen 1, C SW SW 18-5n-8w, flowed 325 barrels from Deese sand, Pennsylvanian 9972-10,011 feet, ⅜-inch, 36-gravity, TD 10,510.

Grady County. Gulf Oil Corp.'s C. E. Costello 1, NE SE 14-5n-5w, flowed 1836 barrels from 1st & 2nd Bromide sand, Ordovician 11,745-890 feet, ½-inch, TD 12,771.

Grady County, Rush Springs, Southwest field. R. C. Graham & Hal Folmer's Foreman 1, SW SW NE 7-3n-7w, flowed 300 barrels from Noble-Olson sand, Permian 3480-98 feet, ⅜-inch, 29-gravity, TD 3697.

Lincoln County, Robinson Creek, East field. Jones, Shelburne & Pellow and Sunray's Roller 1-B, SE SW NE 14-12n-5e, pumped 17 barrels from Viola lime, Ordovician 4550-64 feet, 37-gravity, TD 4663.

Lincoln County, Sweet Home, Northeast field. Lee Evan's Turner 1, SE NE SW 23-15n-3e, Old Well Worked Over, flowed 72 barrels oil and 5 barrels water from Cleveland sand, Pennsylvanian 3370-80 feet, 11/64-inch, TD 5074.

Lincoln County. C. H. Nicholson's John D. Frizzell 1, SE NW SW 28-13n-2e, Old Well Worked Over, pumped 15 barrels from Skinner sand, Pennsylvanian 4934-37 feet, 40-gravity, TD 5200.

McIntosh County. Dalton Sprinkle's Street 1, NE SE SW 33-7s-23e, Old Well Drilled Deeper, pumped 5 barrels from 244-272 feet, 28.5-gravity, TD 302.

Noble County, Otoe City, East field. Empire National Drilling Co.'s Swallow 1, SW NW NW 11-22n-1e, Old Well Worked Over, flowed 10 barrels from Red Fork sand, Pennsylvanian 4308-20 feet, 22/64-inch, 43-gravity, TD 4570.

Noble County, Red Rock, East field. Roy G. Woods' Pipestem 1, SW SW NE 19-23n-2e, flowed 94 barrels oil and 32 barrels water from Skinner sand, Pennsylvanian 3900-3908 feet, 24/64-inch, 44-gravity, TD 4645.

Noble County, Sams, Southwest field. T. N. Berry's Braden 1, SW SW NW 29-21n-2w, pumped 7 barrels oil and 25 barrels water from Misener sand, Mississippian 5171-75 feet, TD 5175.

Osage County, Herd, Southwest field. Sooner Oil Co.'s Osage 1, NW NW NE 7-27n-10e, pumped 46 barrels oil and 50 barrels water from Mississippi Chat, Mississippian 2026-44 feet, 37-gravity, TD 2044.

Texas County, Guymon-Hugoton field. Oceanic Oil Co.'s Swinger 1-A, C NW NE 5-5n-16ecm, pumped 20 barrels oil and 133 barrels water from Des Moines sand, Pennsylvanian 5360-68 feet, 41.6-gravity, TD 6991.

OKLAHOMA—NEW GAS FIELD

Hughes County, Carson, West field. McAlester Fuel Co.'s E. W. Whitney 1, C SW NW 14-8n-11e, flowed 2.2 million from Booch sand, Pennsylvanian 2402-35 feet, ½-inch, TD 3320.

OKLAHOMA—NEW OIL PAY

Creek County, Cushing, East field. Simon & Dassett's Toney 2-A, SE SE NE 24-17n-7e, flowed 20 barrels from Jones sand, Pennsylvanian 1882-93 feet, 41-gravity, TD 2907.

Creek County, Tuskegee, West field. Acorn Drilling Co.'s Moore 1, SE NE NE 34-14n-9e, flowed 400 barrels oil and 240 barrels water from Union Valley lime, Pennsylvanian 3036-42 feet, ¼-inch, 37-gravity, TD 3681.

Grady County, Bradley, Southwest field. Max Pray's Louise Billy 1, C SE NE 4-4n-5w, flowed 266 barrels from Cummingham sand, Pennsylvanian 9892-9945 feet, ¼-inch, 36.8-gravity, TD 10,557.

Lincoln County, Baker, Southwest field. A. L. Smith's Trimble 1, NE NE SE 27-16n-5e, Old Well Worked Over, flowed 9 barrels from Prue & Skinner sand, Pennsylvanian 3361-3424 feet, 38-gravity, TD 4385.

OKLAHOMA—OIL FIELD EXTENSIONS

Grady County, Bradley, Southeast field. Magnolia's T. E. Jones 1, C SE NE 22-4n-5w, pumped 66 barrels from Hart sand, Pennsylvanian 9380-9608 feet, 32-gravity, TD 12,514.

Lincoln County, Parkland, Northeast field. Pace Petroleum-M & M Drilling's Martha Rossenbach 1, SW NE NW 18-16n-5e, flowed 18 barrels from Oswego sand, Pennsylvania 3488-3503 feet, 44-gravity, TD 3606.

OKLAHOMA—GAS FIELD EXTENSION

Texas County, Camrick, Southeast field. The Texas Co.'s Silsdee 1-B, NW NW SE 8-1n-19ecm, flowed 52.0 million from Morrow sand, Pennsylvanian 6569-6600 feet, open, TD 6700.

TEXAS—DISTRICT 1 NEW OIL FIELD

Frio County, "Sleepy Creek." Theljohn Oil Co.'s Carl Davidson 1, Samuel Brown Survey, pumped 36 barrels from Navarro sand, Upper Cretaceous 2403-2406 feet, 42-gravity, completed 10-1-54, TD 2429.

TEXAS—DISTRICT 1 NEW OIL PAYS

Atascosa County, "Bob Hindes" field. Plymouth Oil Co.'s Bob Hindes et ux 3, Luke Bryan Survey 239, pumped 68 barrels from Carrizo sand, Eocene 2093-2102 feet, 18.6-gravity, completed 10-10-54, TD 2102.

La Salle County, "White Kitchen" field. Horace Coon Jr. & C. G. Dunwoody

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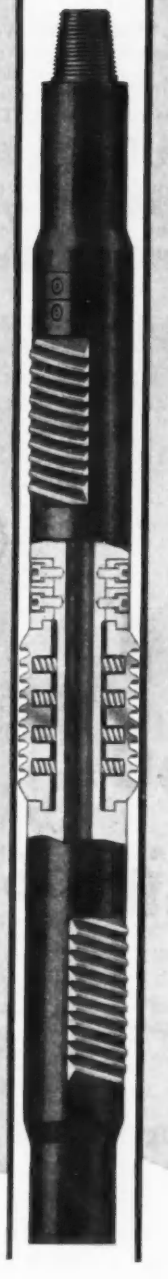

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Jr.'s H. D. Storey, Sr. 2, H&GN Survey 14, pumped 89 barrels from Carrizo sand, Eocene 3305-3309 feet, 38-gravity, completed 10-27-54, TD 3309.

TEXAS—DISTRICT 2
NEW DISTILLATE FIELD

Live Oak County, "Sunset" field. F. Wm. Carr's Albert W. West 2, Cameron County School Land Survey, ungaged from 7671-87 feet, completed 4-15-54, TD 8171.

TEXAS—DISTRICT 2
NEW GAS FIELD

Victoria County. Sam Broadhead's Raymond Karnes et al 1, Block 57, IRR Co. Survey, flowed estimated 12.0 million from 4166-70 feet, open, completed 5-15-54, TD 4505.

TEXAS—DISTRICT 2
NEW OIL PAYS

Jackson County, "Swan Lake, West" field. Southern Minerals Corp.'s State Tract 7-1, Josiah H. Bell Survey, flowed 106 barrels from 8070-75 feet, ⅛-inch, 40.3-gravity, completed 10-19-54, TD 8508.

Refugio County, "Vidaurri" field. Field Drilling Co., et al's James F. Welder Heirs 1, J. Power & J. Hewitson Survey, flowed 129 barrels from Basal Frio sand, Oligocene 5796-5802 feet, 7/64-inch,, 30-gravity, completed 10-30-54, TD 6006.

TEXAS—DISTRICT 3
NEW OIL FIELD

Montgomery County, "Tamina" field. Magnolia's Ina Arcenaux 1, Thomas Taylor ⅓ League, flowed 114 barrels from Wilcox sand, Eocene 9172-75 feet, 9/64-inch, 36.9-gravity, completed 10-14-54, TD 9509.

TEXAS—DISTRICT 3
NEW OIL PAYS

Brazoria County, Bonney field. San Jacinto Petroleum Corp.'s C. Corbett, Jr. et al 1, W. D. C. Hall League, flowed 102 barrels from Frio sand, Oligocene 7607-7609 feet, 10/64-inch, 37-gravity, completed 10-2-54, TD 8007.

Harris County, Clinton field. Southern Oil Well Service Co.'s C. J. Caywood 2, Patrick Reels-John Trobough Survey, flowed 64 barrels from 4564-70 feet, 12/64-inch, 24.3-gravity, completed 10-15-54, TD 5511.

Jefferson County, Big Hill field. R. E. Hibbert's M. B. Finkelstein 1, Section 196, Block 5, W.H.P. McFaddin Survey, flowed 247 barrels from Marginulina sand, Oligocene 9293-99 feet, 8/64-inch, 34-gravity, completed 10-15-54, TD 9400.

Wharton County, "Lou-Hill" field. Caribbean Oil Corp.'s E. G. Hancher 1, T. W. Heard Survey, flowed 120 barrels from Frio sand, Oligocene 5793-95 feet, 8/64-inch, 33.4-gravity, completed 10-12-54, TD 6015.

TEXAS—DISTRICT 3
NEW DISTILLATE PAY

Hardin County, Silsbee, North field. American Republics Corp. & Houston Oil Co.'s O. C. Nelson Fee 7, Old Well Worked Over, flowed 750 barrels distillate and 25.8 million from Yegua 7-A sand, Eocene 7380-83 feet, open, 55.5-gravity, completed 10-6-54, TD 7675.

TEXAS—DISTRICT 3
DISTILLATE FIELD EXTENSIONS

Jefferson County, Marrs McLean field. Clegg & Hunt et al's Frost National Bank 1-A, T&NO (C. H. Lebold) Survey, ⅜-mile north extension, flowed 90 barrels distillate and 4.1 million from Frio "B" sand, Oligocene 10,882-973 feet, 49.5-gravity, completed 10-7-54, TD 12,257.

Montgomery County, Decker's Prairie field. Christie, Mitchell & Mitchell's E. B. Johlke Gas 1, ½-mile northeast extension, flowed estimated 12.0 million from Brautigam sand, Eocene 5440-58 feet, open, completed 10-12-54, TD 5512.

TEXAS—DISTRICT 4
NEW OIL FIELD

Duval County, "Ceniza" field. J. S. Walker & A. W. Gregg Drilling Co.'s Ed & Amando Canales 1, Section 17, Spring Creek Irr. Survey, flowed 118 barrels from Pettus sand, Eocene 4715-24 feet, 10/64-inch, 49.4-gravity, completed 10-24-54, TD 4725.

TEXAS—DISTRICT 4
NEW GAS FIELD

Starr County. R. & S. Oil Co.'s F. B. Guerra et al 1, Share 2, Survey 341, flowed 4.1 million from 2742-56 feet, open, completed, 10-15-54, TD 3520.

TEXAS—DISTRICT 4
NEW OIL PAYS

Duval County, Piedras Pintas field. Bass & Vessels' W. A. Tinney Estate 4, Section 11-A, Survey 8, flowed 66 barrels from 1999-2009 feet, 3/16-inch, 48-gravity, completed 10-13-54, TD 2196.

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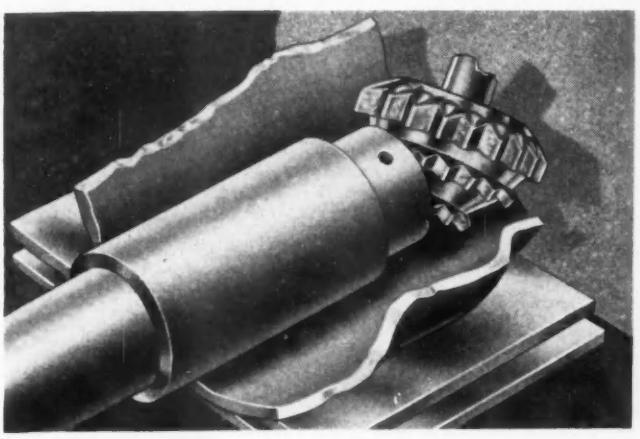

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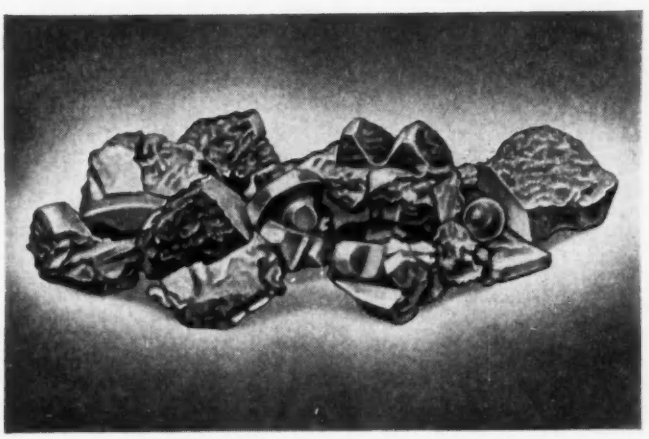

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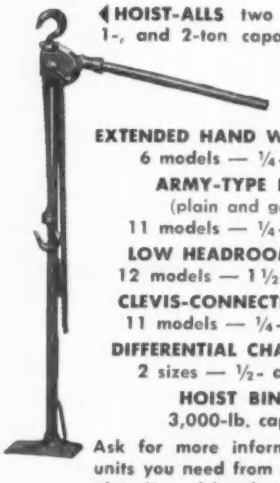

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Jim Wells County, Orange Grove field. H. R. Smith et al's John Schmidt 1, Welhausen-Driscoll Subdivision, Block 2, flowed 73 barrels from Frio-Vicksburg sand, Oligocene 4879-85 feet, 9/64-inch, 35.2-gravity, completed 10-15-54, TD 4915.

Nueces County, Minnie Bock, West field. Edwin L. Cox's A. C. Tiemann 1, George H. Paul Subdivision, flowed 33 barrels oil and 6 barrels water from Frio sand, Oligocene 5897-99 and 5905-08 feet, ⅛-inch, 37.4-gravity, completed 10-5-54, TD 5970.

Webb County, Tal Vez field. Campbell, Calohan & Rowden's O. G. Kirkpatrick 2-A, Section 59, CCSD&RGNG Survey, pumped 95 barrels from Bruni "A" sand, Oligocene 2262-66 feet, 44-gravity, completed 10-11-54, TD 2313.

Webb County, Watkins field. Parr & Delaney Oil Co.'s G. B. Parr 1, San Casimiro Grant, H. K. Boysen Subdivision, pumped 26 barrels oil and 3 barrels water from Jackson-Mirando sand, Eocene 867-880 feet, 20.7-gravity, completed 10-15-54, TD 880.

TEXAS—DISTRICT 4
NEW DISTILLATE PAYS

Brooks County, Mills Bennett field. Mills Bennett Estate's Mills Bennett Estate 11, "El Tule" Juan Jose Guerra Grant, flowed 21 barrels distillate and 3.2 million from Frio sand, Oligocene 5805-15 feet, 67.4-gravity, completed 9-23-54, TD 6299.

Starr County, Hinde field. Sun Oil Co.'s Bentsen Bros. et al A-1, El Panal Grant, flowed 165 barrels distillate and 11.8 million from Frio F-4 sand, Oligocene 5101-5108 feet, open, 65.7-gravity, completed 10-19-54, TD 5275.

TEXAS—DISTRICT 5
NEW GAS FIELD

Freestone County. Humble's M. E. Gehrels et al 1, M. Autry Survey, flowed 7.4 million from Rodessa lime, Lower Cretaceous 8196-8208 and 8224-30 feet, open, completed 10-25-54, TD 9132.

TEXAS—DISTRICT 6
NEW OIL FIELD

Smith County. Sinclair O&G Co.'s E. F. Thompson 1, Jose Maria Procella Survey, pumped 133 barrels from Rodessa lime, Lower Cretaceous 7254-66 feet, 42-gravity, completed 10-7-54, TD 8485.

TEXAS—DISTRICT 6
NEW DISTILLATE FIELD

Rusk County. Magnolia's Don Langston 1, Joseph English Survey, flowed 25 barrels distillate and 6.3 million from Rodessa lime, Lower Cretaceous 6064-89 feet, open, 56-gravity, completed 10-9-54, TD 7480.

TEXAS—DISTRICT 6
NEW OIL PAY

Harrison County, Waskom field. Arkansas Louisiana Gas Co.'s J. T. Strange Unit 1, Ben F. Hooper Survey, flowed 84 barrels from Travis Peak sand, Lower Cretaceous 6234-52 feet, 3/16-inch, 41-gravity, completed 9-21-54, TD 6302.

TEXAS—DISTRICT 7-C
NEW OIL FIELD

Runnels County. Youngblood & Youngblood's Crockett 1, Lawrence Martin Survey 441, Old Well Worked Over, flowed 280 barrels oil and 70 barrels water from Fry sand, Pennsylvanian 4341-52 feet, 20/64-inch, 45-gravity, completed 10-16-54, TD 4882.

TEXAS—DISTRICT 7-C
NEW OIL PAYS

Coke County, Bronte field. Hickok & Reynolds, Inc.'s Robert Forman 2, Section 450, Block 1-A, H&TC Survey, Old Well Worked Over, pumped 21 barrels oil and 14 barrels water from Capps lime, Pennsylvanian 4616-22 feet, 45-gravity, completed 9-8-54, TD 4981.

Coke County, Ft. Chadbourne, West field. C. L. McMahon, Inc.'s A. S. Hendry 1-A, Rafall Ardete Survey 470, pumped 84 barrels oil and 2 barrels water from Cambrian, 5722-27 feet, 2½-inch, 45.5-gravity, completed 10-12, 54, TD 5727.

Crockett County, Pan American Production Co.'s W. E. West 1, Section 1, Block A, Runnels CSL Survey, flowed 256 barrels from Ellenburger lime, Ordovician 8072-88 feet, 16/64-inch, 44.4-gravity, completed 10-8-54, TD 8242.

Upton County, Amacker-Tippett field. Humble's H. M. Halff Estate 1, Section 20, Block Y, GC&SF Survey, flowed 408 barrels from Wolfcamp lime, Permian 8967-82 and 8992-9018 feet, 19/64-inch, 42.8-gravity, completed 10-16-54, TD 9025.

TEXAS—DISTRICT 7-C
OIL FIELD EXTENSION

Runnels County Service field. Service Drilling Co.'s W. L. Alcorn 1, Richard Brady Survey 314, 1-mile south extension, flowed 133 barrels from Cross Cut sand, Pennsylvanian 3277-88 feet, 20/64-inch, 45-gravity, completed 10-9-54, TD 3288.

TEXAS—DISTRICT 8
NEW OIL FIELDS

Andrews County, "Bristol" field. Humble's W. E. Bristol 1, Section 5, Block A-37, PSL Survey, pumped 28 barrels oil and 14 barrels water from Wichita-Albany sand, Permian 7470-7503 feet, 35.2-gravity, completed 9-28-54, TD 8606.

Crane County. Texas Pacific Coal & Oil Co. et al's H. E. Adams Farm 1-A, Section 8, Block B-24, PSL Survey, flowed 196 barrels oil and 10 barrels water from Wolfcamp lime, Permian 7890-7990 feet, 28/64-inch, 38.8-gravity, completed 8-4-54, TD 12,013.

Dawson County. Seaboard Oil Co.'s Woodul 2, Section 34, Block 34, T-5-N, T&P Survey, flowed 203 barrels from Spraberry sand, Permian 7484-7500 and 7538-74 feet, ⅜-inch, 42-gravity, completed 10-4-54, TD 8291.

Kent County. Sunray Oil Corp.'s M. L. Reed 1, Section 2, John Rodman Survey, flowed 185 barrels from Canyon sand, Pennsylvanian 6108-20 feet, 20/64-inch, 38-gravity, completed 10-4-54, TD 7398.

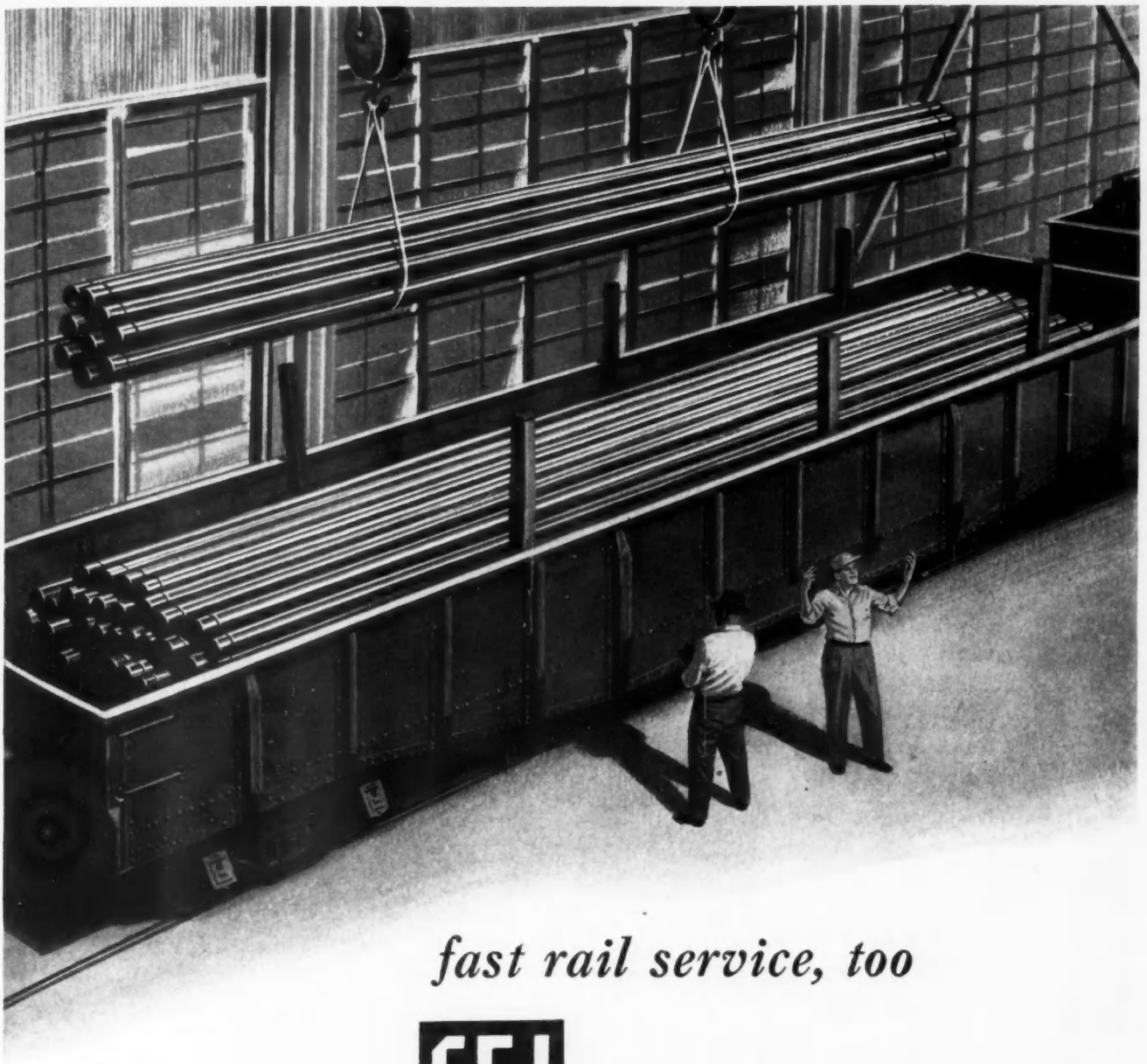
Midland County. Warren Petroleum Corp.'s TXL 2-G, Section 39, Block 41, T-3-S, T&P Survey, Old Well Worked Over, flowed 70 barrels from Fusselman lime, Silurian 12,524-570 feet and 12,592-616 feet, ½-inch, 45-gravity, completed 9-26-54, TD 13,400.

Sterling County, "Sterling County" field. A. F. Walker et al's T. H. Humble 1, Section 30, Block 11, SPRR Survey, pumped 35 barrels from San Andres lime, Permian 1452-60 feet, 31-gravity, completed 10-21-54, TD 1460.

TEXAS—DISTRICT 8
NEW OIL PAYS

Andrews County, Block A-34 field. Hunt Oil Co.'s D. S. Bell et al 1, Section 14, Block A-34, PSL Survey, flowed 264 barrels from Strawn sand, Pennsylvanian 9926-50 feet, ⅛-inch, 48.6-gravity, completed 10-7-54, TD 14,000.

Andrews County, Fullerton, South field.



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Stanolind & The Texas Co.'s Lotus Oil Co. 6-C, Section 17, Block A-48, PSL Survey, Old Well Worked Over, flowed 132 barrels from Connell sand, Ordovician 10,790-810 feet, 2-inch, 36.6-gravity, completed 10-16-54, TD 11,099.

Midland County. Forest Oil Corp. & Cities Service Oil Co.'s Dora Roberts 1-B-1, Section 42, Block 41, T-2-S, T&P Survey, flowed 2163 barrels from Ellenburger lime, Ordovician 12,835-13,012 feet, 1-inch, 52.2 gravity, completed 10-10-54, TD 13,012.

Terry County. Midwest Oil Corp.'s M. F. Gueterslon 1, Section 20, Block C-37, PSL Survey, flowed 365 barrels from Wolfcamp Reef lime, Permian 8846-64 feet, 14/64-inch, 42-gravity, completed 10-17-54, TD 8940.

TEXAS—DISTRICT 8 NEW DISTILLATE PAY

Winkler County, Emperor field. J. C. Barnes & C. V. Lyman's Kerr 1, Section 26, Block B-5, PSL Survey, flowed 2424 barrels distillate and 160.0 million from Ellenburger sand, Ordovician 11,480-525 feet, 20/64-inch, 58-gravity, completed 10-8-54, TD 11,662.

TEXAS—DISTRICT 8 NEW GAS PAY

Ward County, HSA field. Gulf Oil Corp.'s Hutchings Stock Association 282, Section 82, Block N, G&MMB&A Survey, flowed 11.5 million from O'Brien sand, Permian 2355-75, 2400-55 and 2490-2590 feet, 2½-inch, completed 10-5-54, TD 3055.

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TEXAS—DISTRICT 8 OIL FIELD EXTENSIONS

Crane County, Sand Hills, West field. McElroy Ranch Co., & Newmont Oil Co.'s McElroy-Newmont Estes Estate 7-31, Section 7, Block B-28, PSL Survey, ¾-mile southwest extension, pumped 152 barrels oil and 5 barrels water from Glorieta lime, Permian 3820-34 and 3840-60 feet, ½-inch, 29-gravity, completed 10-7-54, TD 8051.

Gaines County, Amrow field. Amerada Petroleum Corp.'s Whitaker 1-A, Block 2, League 311, Gaines CSL Survey, southeast extension, flowed 604 barrels from Devonian lime, Devonian 12,605-665 feet, ⅝-inch, 35.6-gravity, completed 10-2-54, TD 12,665.

Garza County, P. H. D. field. La Gorce Oil Co.'s O. B. Franklin 1, Section 1246, AB&M Survey, ½-mile north extension, pumped 108 barrels oil and 20 barrels water from San Andres lime, Permian 3575-82 and 3595-3605 feet, 38-gravity, completed 10-23-54, TD 4223.

Howard County, Snyder field. Lipkin & Devine's Susie B. Snyder 1, Section 20, Block 30, T-1-S, T&P Survey, ½-mile northwest extension, pumped 256 barrels from San Andres lime, Permian 2565-2600 feet, 32-gravity, completed 10-8-54, TD 2600.

Midland County, Virey field. Warren Petroleum Corp.'s Emma D. Gray 2, Section 27, Block 41, T-3-S, T&P Survey, ½-mile south extension, flowed 1238 barrels from Ellenburger lime, Ordovician 13,200-311 feet, ½-inch, 52-gravity, completed 10-1-54, TD 13,311.

TEXAS—DISTRICT 10—NEW OIL FIELD

Hansford County. R. H. Fulton's S. B. Lasater 1, Section 62, Block 45, H&TC Survey, flowed 498 barrels from Morrow sand, Pennsylvanian 7040-50 feet, ¾-inch, 39.5-gravity, completed 10-22-54, TD 7520.

TEXAS—DISTRICT 10—NEW GAS FIELD

Dallam County. Humble's Kerrick Gas Unit 2 (Sheldon) 1, Section 16, Block 50, H&TC Survey, flowed 8.5 million from Pennsylvanian lime, 3564-3624 feet, completed 10-5-54, TD 6214.

TEXAS—DISTRICT 10 NEW OIL PAY

Sherman County, Hugoton field. Phillips Petroleum Co.'s Kathryn 1-B, Section 20, Block 3-B, GH&H Survey, flowed 50 barrels oil and 40 barrels water from Missouri lime, Pensylvanian 5382-96 feet, ½-inch, 37.9-gravity, completed 10-5-54, TD 7280.

WYOMING—NEW OIL FIELD

Fremont County. Sinclair's Unit 1, NW NW NW 8-28n-92w, pumped 30 barrels oil and 60 barrels water from Phosphoria lime, Permian 8010-77 feet, 28.8-gravity, completed 10-1-54, TD 8462.

WYOMING—OIL FIELD EXTENSIONS

Converse County, Big Muddy field. Canada Southern Oils, Ltd.'s McCauley State 5, W½ SW SE 23-33n-76w, southeast extension, pumped 152 barrels from Muddy sand, Upper Cretaceous 5580-5610 feet, completed 10-14-54, TD 5374.

Natrona County, Bolton Creek field. J. G. Dyer's Morgan-Dyer-Government 1, SW SW 3-29n-81w, 1-mile extension, pumped 50 barrels oil and 330 barrels water from Embar lime, Permian 2050-55 feet, completed 10-27-54, TD 2193.

How You Can Lower Your Drilling Costs With a Planned Crooked Hole Program

Proper selection of drill collar size and placement of stabilizers and reamers will reduce greatly the cost per foot.

By R. J. BROMELL, Great Western Drilling Company, Midland, Texas

THE USE of increased weight on the bit to obtain faster penetration rates has increased the problem of maintaining a straight hole within contract deviation limits. In many cases the formations in which it is most difficult to control deviation are formations which cannot be drilled economically with light weight. It is not uncommon for the cost to drill such formations to be as high as $200 per foot.

This article is intended to illustrate the results obtained in drilling under crooked hole conditions. Series of controlled tests were made using new drilling techniques based on available technical data,[1] geological and other drilling information. Although the use of oversize drill collars (collars which have insufficient clearance in the hole to wash-over) has been tried for some time, little effort has been made to analytically evaluate their effectiveness. These tests largely confirm the charts prepared by Woods and Lubinski[1] and illustrate the usefulness of these theoretical data.

The practices which evolved from these tests included the use of stabilizers and reamers for which there was no published theoretical data. Mathematical analysis of the placement of stabilizers have since been made and results closely approximate the positions found in practice to be desirable.

There is no known method by which crooked holes can be economically eliminated. Such things as changing bit types, deleting teeth from bits, deleting cones, using limber members on the bottom of the drill stem, stabilizing, reducing hole size, and then reaming to the desired size, running light weight and then suddenly increasing weight—all of these things have been tried. With the exception of stabilizing, the effect of any of these methods is questionable and experience has shown that the results cannot be predicted or reliably repeated.

The cause of crooked hole, however, and the effect of drill collar size, weight on the bit, stabilizers and related factors have been analyzed mathematically. This information makes it possible to approach the crooked hole as a scientific problem instead of another unplanned experiment.

Through the proper application of the available technical data on crooked holes, drilling costs can be reduced. The amount to be saved will vary with the individual case or locality. When provided with a knowledge of the area in question a practical man can now plan and drill with confidence. The well to be drilled can be classified according to its severity and the best known methods can be employed to combat the situation. Prior planning, utilizing available data, is indeed essential to economically drilling through crooked zones.

Theoretical study. To prepare for the trend of thought used in explaining the behavior of various types of crooked holes, a brief review of the basic concepts will be made.

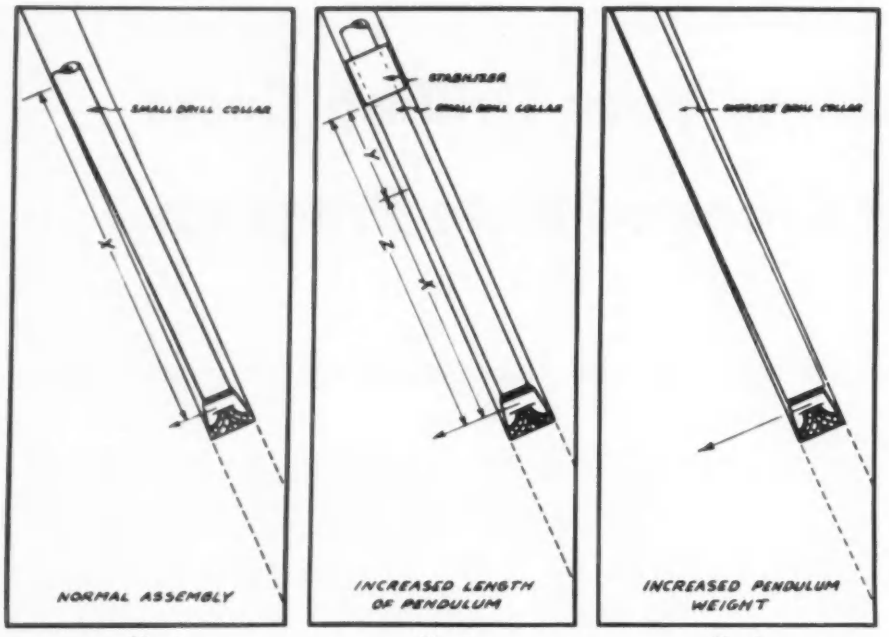
It is assumed that drill collars will lay on the low side of the hole as the hole deviates from vertical. The drill collars are assumed to act as a pendulum from the point of contact with the wall of the hole to the bit; this length, supported only by the bit, tends to swing toward vertical. This tendency applies a lateral force on the bit which causes the bit to cut sideways and acts as a "hole straightening" force.

The amount of this force can be increased by (1) lengthening the "pendulum" section, (2) increasing the weight of the "pendulum" section, or (3) by increasing the angle from vertical. These variations are illustrated in Figure 1.

Illustrations are simplified for the purpose of setting forth the principle forces acting on the bit. The forces, which determine the hole deviation and drilling progress are (1) the weight on the bit, (2) the reaction of the formation tending to deviate the hole, and (3) the straightening effect of the drill collar "pendulum" trying to return to vertical. These forces are shown in Figure 2.

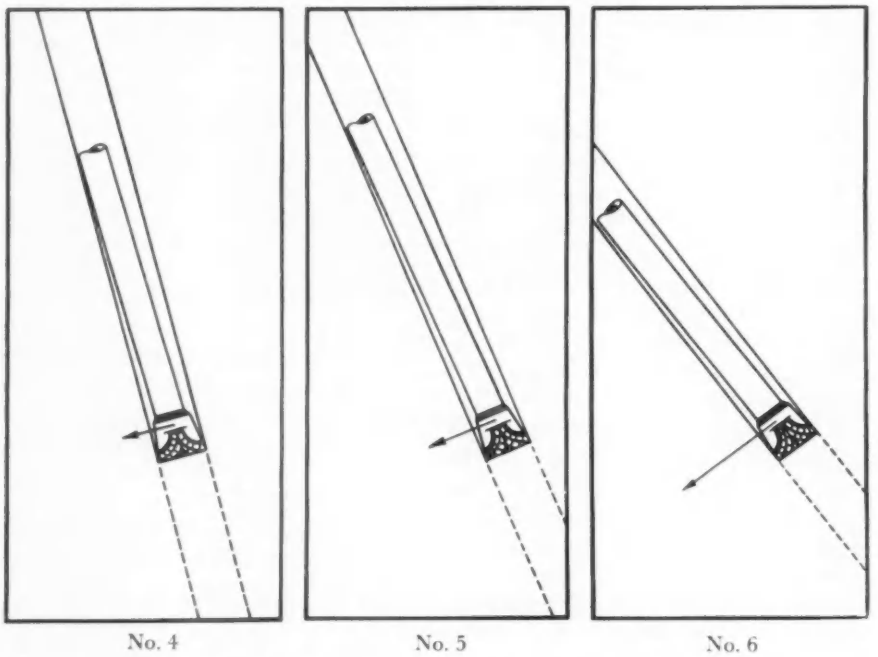
If the forces are in lateral balance, the hole angle will continue unchanged as is shown at Point A. A change in deviation must be preceded by some change in the direction or strength of the forces at the bit, as occurs at Point B. These forces can be thrown out of balance by increasing or decreasing the bit weight, by changing drill collar size, by stabilizing or by a change in formation characteristics.

In a near vertical hole, such as shown in Figure 2 to Point A, the bit moved downward since the lateral components of the forces were in balance. When the bit reached Point B the horizontal reaction of the formation tending to push the bit away from



No. 1 No. 2 No. 3

Increasing straightening force by changing drill stem assembly.



No. 4 No. 5 No. 6

The greater the hole angle, the greater the straightening force.

FIGURE 1

vertical was greater than the straightening force of the drill collars and the hole started to deviate from vertical.

By the time Point C was reached the straightening force of the collars had increased as the hole angle increased until the lateral forces were again balanced. The section from Point C to Point D is straight though inclined, which means that a state of equilibrium has been reached and no change in angle will take place until the lateral balance is changed.

A change in hole deviation obtained by a change in weight is illustrated in Figure 3. As the weight was decreased the lateral forces became unbalanced, the pendulum force of the drill collars being greater than the horizontal reaction of the formation, and the hole started to straighten. At Point C the lateral forces once again balanced and the hole remained straight while drilling progressed to Point D. In this case drilling progress will be retarded as bit weight has been decreased in order to reduce hole angle.

The same effect can be obtained by substituting larger drill collars, which increases the pendulum force of the drill collars and reduces the hole angle until a state of equilibrium is reached, as illustrated in Figure 4. At Point C the forces have again become balanced and the hole will continue at this angle. Note that in this case drilling progress is not retarded as the bit weight remains constant, but reduction in angle is accomplished by increasing the pendulum effect of the drill collars.

A similar result can be obtained by using a stabilizer with the small collars to raise the point of contact of the drill collars with the wall of the hole, as shown in Figure 5. The pendulum length is shown as Distance Y without the stabilizer and is increased to Distance X by use of a stabilizer. The increase in the length of the collars acting as a pendulum increases the force tending to return the collars to the vertical position. As the hole is drilled from Point B to Point C the deviation decreases and the lateral balance is again established. Again, drilling progress has not been retarded, as the hole angle has been decreased without reduction of the weight on the bit.

Doglegs. The production departments of some oil companies which are producing from wells with large deviation angles no longer consider hole deviation in itself to be detrimental. Some confusion and misinformation still exists among those not familiar with such practices and the old standard of 3° or 5° maximum deviation are still misleading criteria.

Production or drilling troubles caused by sudden changes in direction

frequently have been blamed on high deviation angles. Wells drilled to a graduated deviation limit which increases as depth increases are costing operators thousands of dollars unnecessarily.

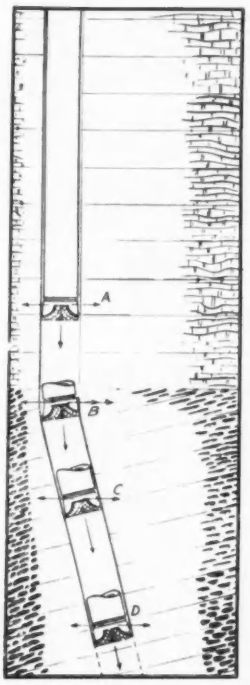
A careful study of producing wells with high deviation angles and controlled rates of change should be made and contract procedures examined to determine if the present specification of maximum hole angle is penalizing the producer. Strict adherence to small deviation angles may in some cases penalize the producer in two ways. Forced light weight to maintain small angles raises the cost per foot and the producer must eventually pay this increased cost of drilling.

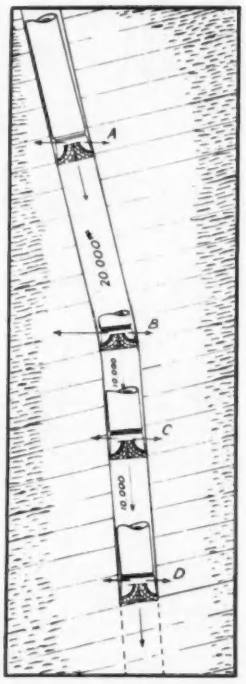
In cases where the hole angle rapidly approaches the contract limit, the producer pays for and sometimes insists on drilling practices which result in a dogleg being formed in the hole. Naturally, no one specified that a dogleg be put in the hole but through a diligent effort to keep the hole straight the deviation is held within limits only by a drastic reduction of weight.

A misunderstanding as to what actually causes trouble in a producing well has led to a false feeling of security in maintaining small deviation angles. Certainly, deviation angle is important but it is by no means the only important factor and should not be used as the sole guide by which to judge the ability of a well to produce trouble free. These various factors have been under study and new methods to define "crooked hole" for contract purposes have been proposed.[2]

Figure 6 has been drawn to clarify what happens when abrupt changes in weight are made to control hole deviation. It is apparent from this illustration that even though the desired hole angle was maintained, the well bore was not as trouble-free as might be expected. In a hole approaching contract limit, Point A, a large reduction in weight has been made, a dogleg formed, and a smaller deviation reading obtained at Point B. Reduction in hole angle has stopped at this point because the collars touched the wall of the hole at a point close to the bit and the straightening force is lost.

The hole will continue to drill at this angle until Point C, when the





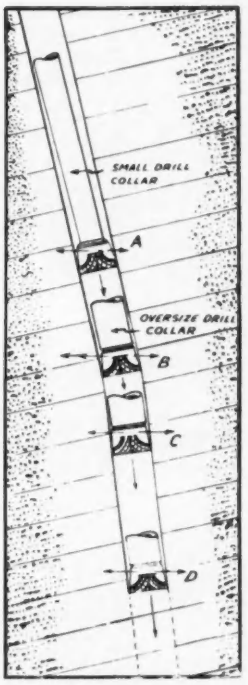
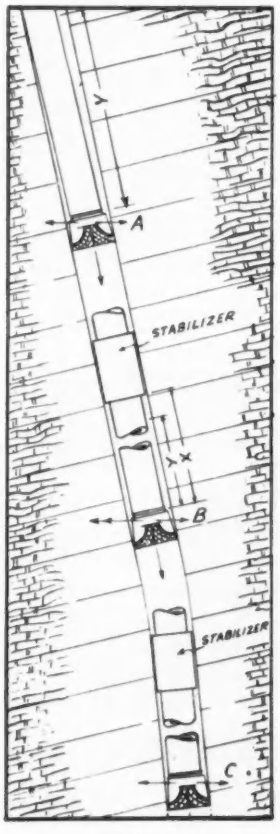
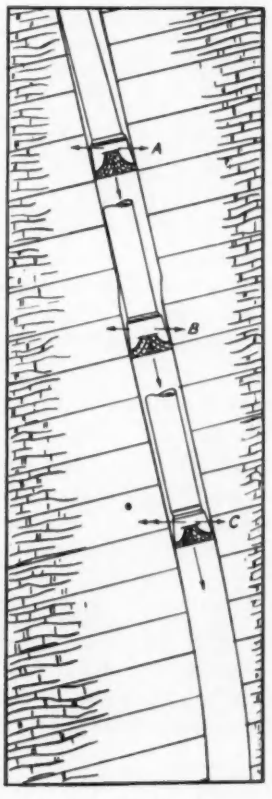


Fig. 2 (left)—Increase deviation and establishment of new equilibrium condition after change in dip.

Fig. 3 (center)—Reducing hole deviation by reduction in weight on bit.

Fig. 4 (right)—Reducing hole deviation by increasing pendulum weight.





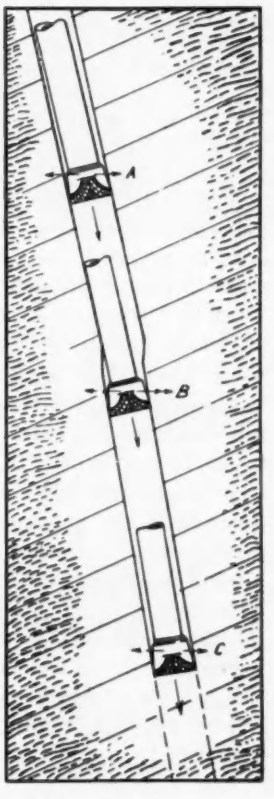


Fig. 5 (left)—Reducing hole deviation by increasing pendulum length.

Fig. 6 (center)—Formation of Dogleg by rapid reduction of weight on bit showing eventual reduction in hole angle.

Fig. 7 (right)—Formation of dogleg in a more severe crooked hole zone showing slight increase in deviation angle.

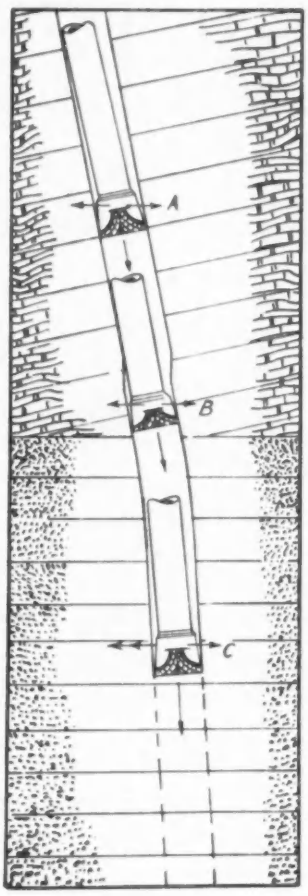


Fig. 8 (**left**)—Hole straightening after increase of bit weight near bottom edge of crooked hole zone.

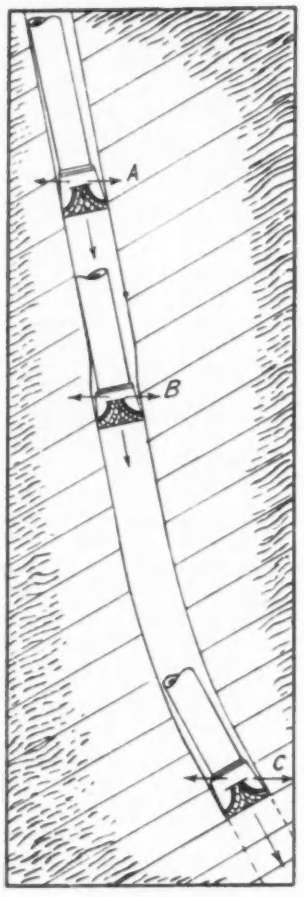


Fig. 9 (**right**)—Effect of increased bit weight when a considerable section of crooked hole zone remains to be drilled.

pendulum length of the collars increases enough to produce a straightening force which will overcome the formation reaction. The hole then gradually straightens until the equilibrium condition is reached.

Figure 7 illustrates a variation of this condition in a more severe crooked hole zone. When the dogleg was formed and the drill collars contacted the wall of the hole near the bit, the pendulum force was lost and sufficient formation reaction existed to actually increase the hole deviation slightly. If the hole is permitted to progress the formation's force will be overcome by the increase in pendulum effect of the collars and a new equilibrium will be established.

The new deviation established will be greater in Figure 7 but in both Figure 6 and Figure 7 better results could have been obtained without the hazard of the dogleg by a gradual reduction of bit weight. Often the tendency is to lighten the weight even further if a deviation survey is made showing the hole angle to be increasing slightly after the dogleg is formed in the case of Figure 7. This practice costs even more money since a reduction in weight will generally slow the drilling rate.

Many field men can remember places where a hole was straightened by "fanning bottom" and then "throwing the weight to it" after recording an indication that the hole is beginning to straighten. In several cases which have been examined the situation paralleled that illustrated in Figure 8. After a long period of various experimental operations which carried drilling progress to near the lower edge of a crooked hole zone, light weight operation was tried and the dogleg was formed.

After getting a slight reduction in hole angle the weight was increased to several thousand pounds per inch of bit diameter. Drilling progress immediately increased and when Point B was reached the formation had changed and lateral force of the formation was very much reduced.

The hole angle reduced to near vertical and the hole is said to have been straightened by weight. This was the actual case in several instances examined.

One other actual case is illustrated in Figure 9. This situation was similar to that shown in Figure 8 except that a considerable section of the crooked zone remained and the hole angle went to 9°. This is an actual case in which the weight failed to straighten the hole.

Apparently the trick to straightening a hole by increasing the weight lies in knowing when the formation will change. In many cases this can be planned and the drilling rate profitably increased while approaching the formation of lesser dip.

In all of the illustrations on doglegs it should be noted that the size of the dogleg and the rate of change of hole deviation will be much less for large drill collars as they will touch the hole wall sooner as the bit cuts sideways.

Solution of actual drilling problems. Many cases where theoretical data have been confirmed by actual results are available and a few have been selected to illustrate certain types of problems and how they were solved.

When dealing with basic laws of mechanics and physics the same results will be obtained if the laws are adhered to, regardless of the locality. A rock bit and drill collar have no way of knowing where they are and it is foolish to assume that this system is workable for West Texas but not for the Rocky Mountains; that it works for "hard rock" country, but not in coastal areas.

In preparation for drilling crooked hole learn all possible about the area; the depth, thickness and severity of crooked zones. After this has been done the best equipment for the job can be selected, the program planned and the hole can be drilled as economically as possible for the conditions which exist.

Example 1. Two rigs were moved into a new field where limited infor-

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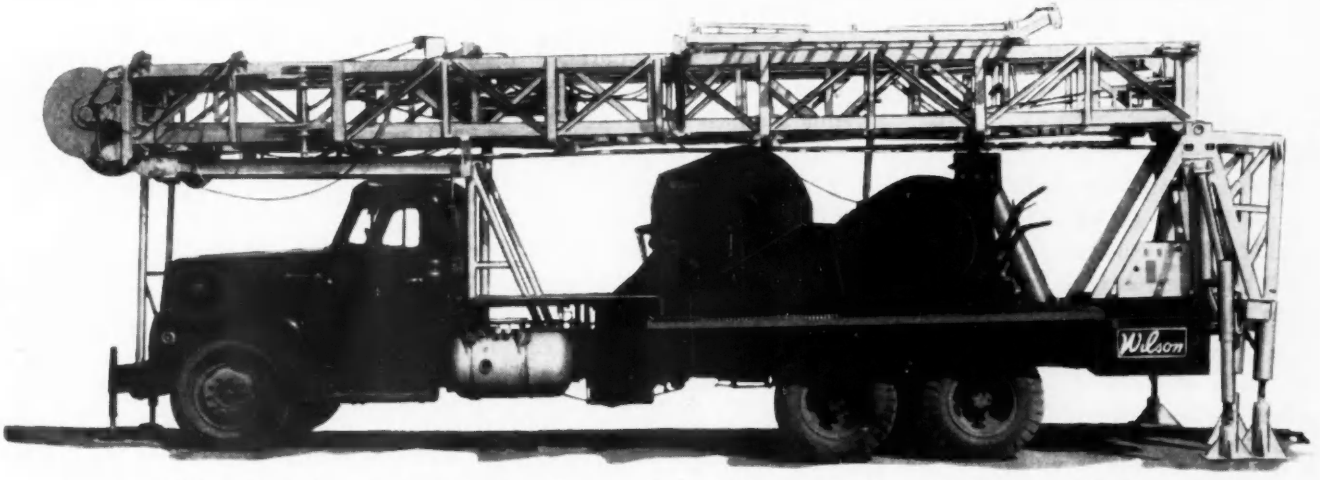

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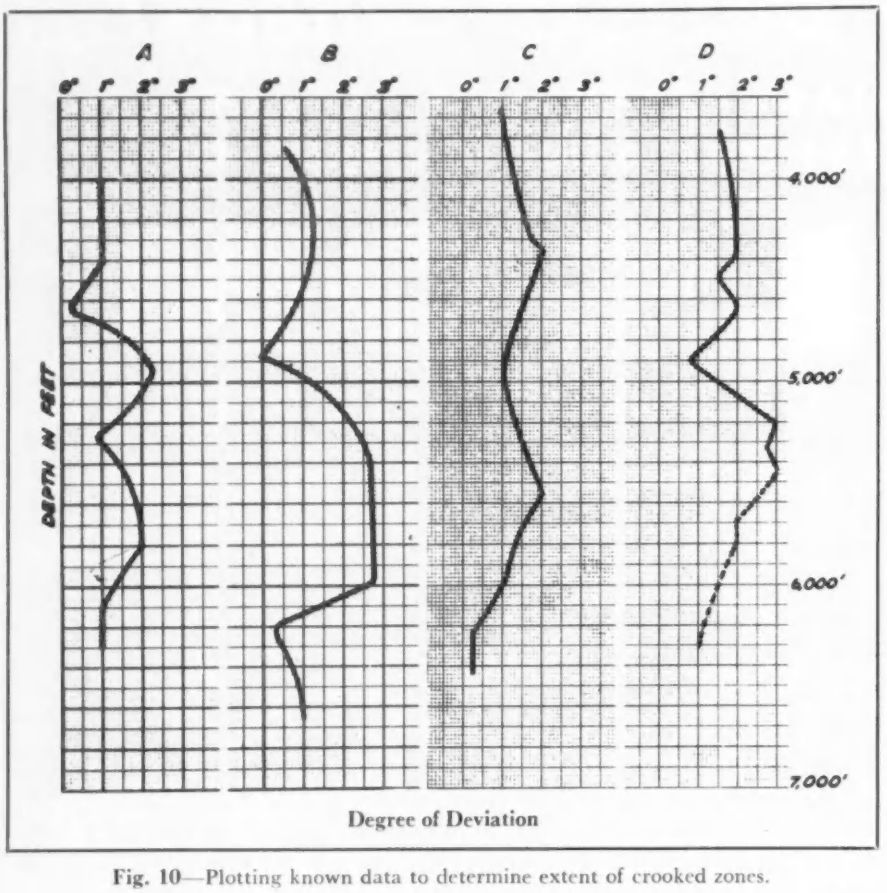


Fig. 10—Plotting known data to determine extent of crooked zones.

mation was available. The records available did not show any severe crooked hole sections so no preventive measures were taken. Crooked hole was encountered with Rig A, but it was not severe. Rig D hit the same zone and found conditions were more severe and difficult to drill.

Figure 10 was drawn to show depth versus hole angle for Rig A and the other two wells which had been drilled. This graph was made only to show the depth at which deviation changes could be expected and ignores all other factors such as changes in drilling practice.

It was noted that in each of these three wells the deviation angle increased at 5200 feet and in each case returned to near vertical at 6100 feet. The well Rig D was drilling was plotted next to the other curves and it, too, showed an increase in angle at 5200 feet. It was then reasonable to assume that it would start to lose angle as it approached 6100 feet. The weight was gradually increased from 5000 pounds to 20,000 pounds in the lower portion of the crooked hole section and the drilling rate was increased from 2.56 feet/hour to 13.2 feet/hour.

By predicting where the hole would straighten, heavy weight could be run through a zone when normally light weight would have been carried. Starting the heavy weight program at the maximum deviation of 3°, as indicated by the broken line in Figure 10, Well D, the hole had returned to 2° at the end of the first bit run and continued to reduce angle to 1° as drilling progressed.

These first two wells (A and D) required an average of 62 bits, 60 days and 720 rotating hours. With proper planning and accumulated knowledge of the area wells are now drilled with 40 bits, 42 days and 535 rotating hours, a saving of 22 bits and 18 days.

From the Woods and Lubinski charts it was determined that 8¾-inch hole using 8-inch drill collars would be more economical to drill than the 7⅞-inch hole, 6-inch drill collar combination used on the first two wells. Calculated on a basis of 3° maximum deviation, 15,000 pounds was carried with the 6-inch collars in 7⅞-inch hole and 34,000 pounds could be carried with 8-inch collars in 8¾-inch hole at the same deviation. Actual drilling in this field with 35,000 pounds, 8-inch collars and 8¾-inch hole produced a maximum deviation of 2¾°, which was reached after most of the section had been drilled. The 35,000 pounds weight was used to drill the entire section and the hole was free of doglegs.

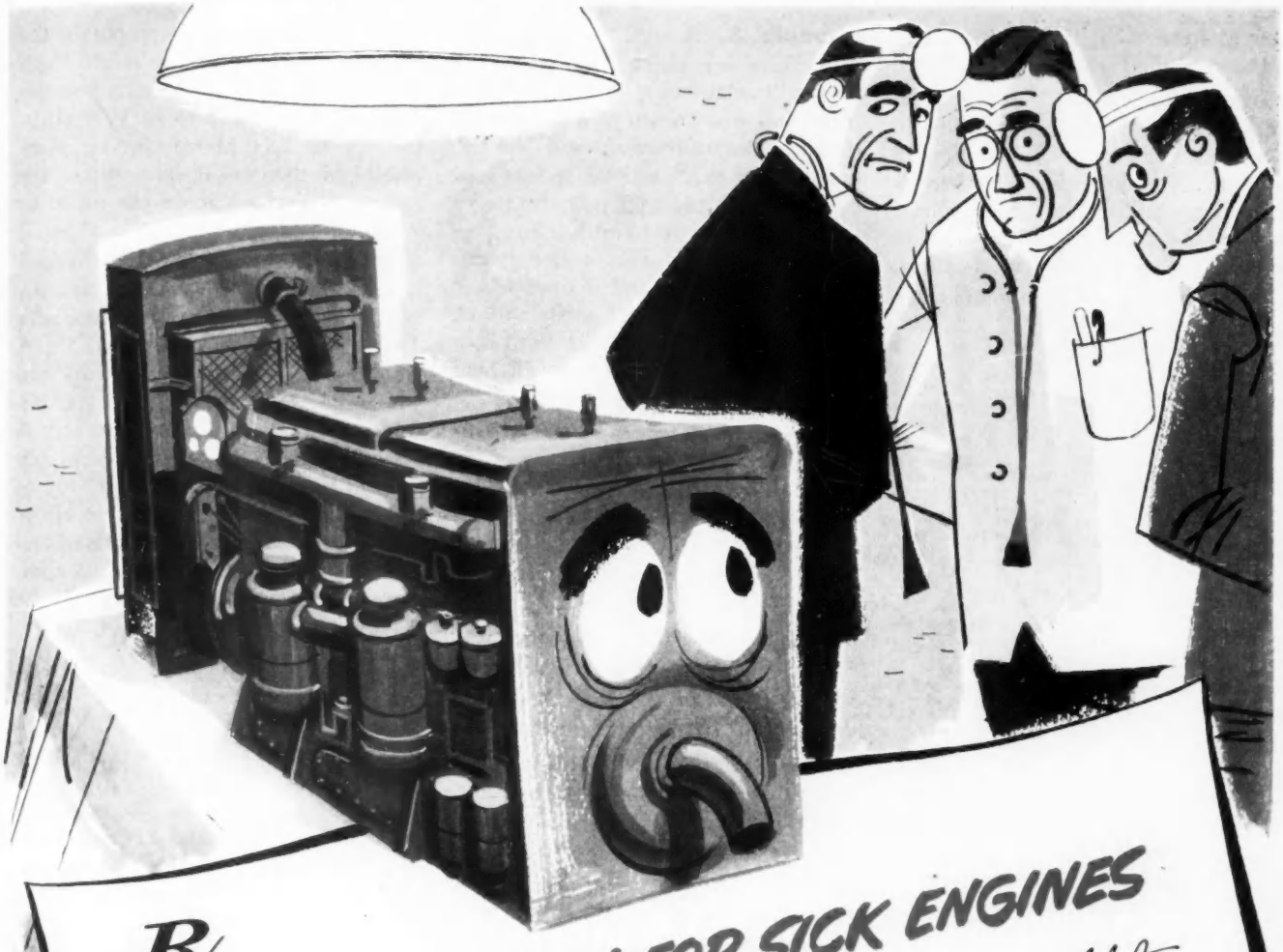
In this area electric logs and sample descriptions have been used to correlate the wells and when crooked zones are approached in drilling, reamers are placed just above the bit to retard the rate at which the hole gains angle. It is accepted that the hole will be allowed to approach the maximum contract angle since the most economical drilling rate will be at the maximum weight usable to establish equilibrium just under the contract limit.

To retard the rate at which the hole gains angle permits more hole to be made under heavy weight conditions before weight must be reduced to establish equilibrium near the contract limit. No set rule can be made to say when reamers should be used or stabilizers moved in the string. Proper use of these tools comes from field analysis experience.

An excellent knowledge of the crooked zone formation is necessary to properly evaluate results. The presence or absence of reamers can have a profound effect on drilling angle and rate of change of this angle.

Three crooked zones exist in each hole drilled in this area and similar solutions have been applied to each zone. The savings mentioned are cumulative for all zones and not for the one zone shown in Figure 10.

Example 2. Records available in two wells drilled in Gaines County, Texas, showed a marked tendency for the wells to deviate at approximately 6300 feet. The most severe section came at approximately 7800 feet but the entire



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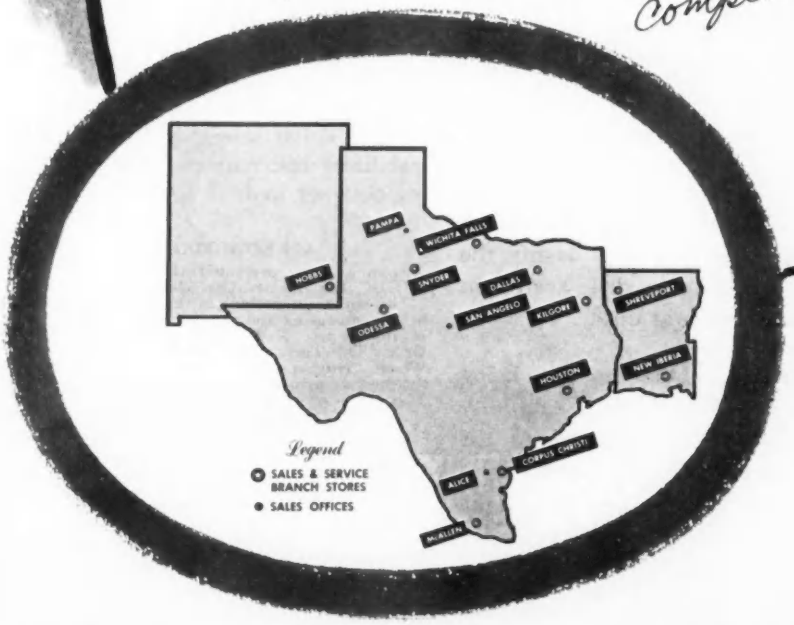

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interval from 6300 feet to 8400 feet had to be drilled with light weight.

An analysis was made of the hole size, weight on bit, drill collar size and hole deviation through the section in question. The Lubinski and Woods curves were utilized and an estimate made as to how much faster the well could be drilled with oversized collars.

Table 1 presents a tabulated account of what was done.

TABLE 1

WELL	Hole Size	Collar Size	Wt. 1000's	Max. Deviation	No. Bits Through Zone	Days Through Zone
A.....	7¾"	5¾"	22	4°	63	66
B..... Calculated	8⅝"	5¾"	18	3°	58 4 Dia.	45
C..... Actual	8¾"	8"	47	4°	?	30
C	8¾"	8"	40	3°	42	32

Thirteen days and 22 bits were saved by using the oversize collars and drilling at maximum deviation angle. The most rapid rate of penetration will be obtained when the hole angle is near the contract limit. To reduce the weight and straighten the hole only results in slower penetration and greater cost per foot.

Why drill with light weight and maintain 1° or 2° when the drilling rate can be increased while maintaining and controlling deviation at 3° or even 4°? Once the equilibrium angle is obtained the hole is under control; that is, to increase weight slightly increases the hole angle and conversely, to decrease weight decreases the hole angle.

In the first two wells listed in Table 1 the contractors actually did establish equilibrium. They continually reduced weight and found that they had to maintain a large angle and comparatively heavy weight to drill the hard formation. Several runs were made with the same weight and the hole remained at the same angle which means the hole was in equilibrium. The small collars offered a small straightening force and consequently the weight had to be reduced. The Lubinski and Woods charts offered a means of calculating the effect of using larger drill collars and increasing the pendulum effect. The use of larger drill collars permitted more weight on the bit while keeping the hole in lateral equilibrium at the same deviation angle.

Example 3. A well in the Rocky Mountains was being drilled with 6-inch drill collars in a 9-inch hole. The formation was known to dip 3°. At a depth of only a few hundred feet the hole was off to 4° and the weight had been reduced to 4000 pounds. Every known bit type and construction was used, including two cutter, three cutter, four cutter and diamond bits. In 24 days 1747 feet were drilled, using 40 bits, including diamond bits. Four degrees deviation was still held with 8000 pounds of weight.

It was calculated from the Woods and Lubinski charts that with a 5° deviation and 8-inch drill collars, 17,000 pounds could be run. Permission was obtained to try this procedure. Two 8-inch collars were run immediately above the bit with 6-inch collars completing the string, and 17,000 pounds was placed on the bit. Eight days later 857 feet had been drilled with 13 bits and the hole was at 4¼°. At this point the operator chose to try to straighten up the hole. The 8-inch collars were removed and light weight operation resumed.

The final result at this writing was the establishment of a 5° to 5½° deviation angle. Twenty-three bits had been used to drill 1019 feet. Bit usage had been higher due to the practice of reducing the hole size and then reaming to full size.

Table 2 is a presentation of the progress on this well:

TABLE 2

Depth From	To	Feet Drilled	Bits Used	Days	Feet Per Bit	Cost/Ft. @ $40/Hr. Rig Time
1091	2838	1747	40	24	42.15	19.50
2838	2696	857	13	8	65.5	12.20
3696	4715	1019	23	17	44.3	20.15

Many wells such as the one described in Table 2 are being drilled every day. Can we truly justify the expense of trying to drill a straight hole in areas such as this?

Example 4. Stabilizers are being used to increase the straightening force of the drill collars by increasing the distance between the bit and the point at which the drill collar contacts the side of the hole. The distance the stabilizer is placed above the bit depends upon the hole size and the collar size. When trying to obtain the maximum straightening effect with 6¼-inch collars in a 7⅞-inch hole the stabilizer was found to be very effective at 68 feet above the bit. Unpublished theoretical data shows the optimum distance above the bit to be 73 feet.

While drilling a crooked 7⅞-inch hole with 6¼-inch drill collars the hole was in lateral equilibrium with 15,000 pounds of weight at 3°. A stabilizer was placed in the string and the same weight carried on the bit. The hole now stabilized at 2°. A weight of 20,000 pounds was placed on the bit and the hole stabilized at 3°. Several changes were made in the weight and stabilizer arrangement and it was found that 5000 pounds additional weight could be carried on the bit when properly using the stabilizer.

Summary. It has been shown that various methods of drilling crooked holes, all based on straightening the hole, are questionable in their effectiveness and certainly can prove to be expensive practices. A planned scientific approach to the crooked hole problem through the use of Lubinski and Woods charts can in most cases result in lower drilling costs. Although great improvement is made in many cases there are still cases where the conditions are so severe it is necessary to drill with light weight. It is now possible to know if you are drilling in such a formation. If it is severe, drill it as such and be satisfied, for experimenting will only cost more money and may lead to trouble.

Crooked hole can best be handled through planning. Check to find out where the hole will go off, how severe it will probably be, when the hole will be straightened, and what size hole must be drilled. Proper selection of drill collar size and placement of stabilizers and reamers greatly reduce the cost per foot.

ACKNOWLEDGMENT

From a paper presented at annual meeting of AAODC, Los Angeles, Oct. 11-14, 1954.

The author is grateful to the following for their help in procuring and evaluating the material used in this paper: J. M. Rollins, W. S. Bachman, Drilco Oil Tools, Inc., Midland, Texas; H. B. Woods, Hughes Tool Company, Houston; and Arthur Lubinski, Stanolind Oil and Gas Company, Tulsa.

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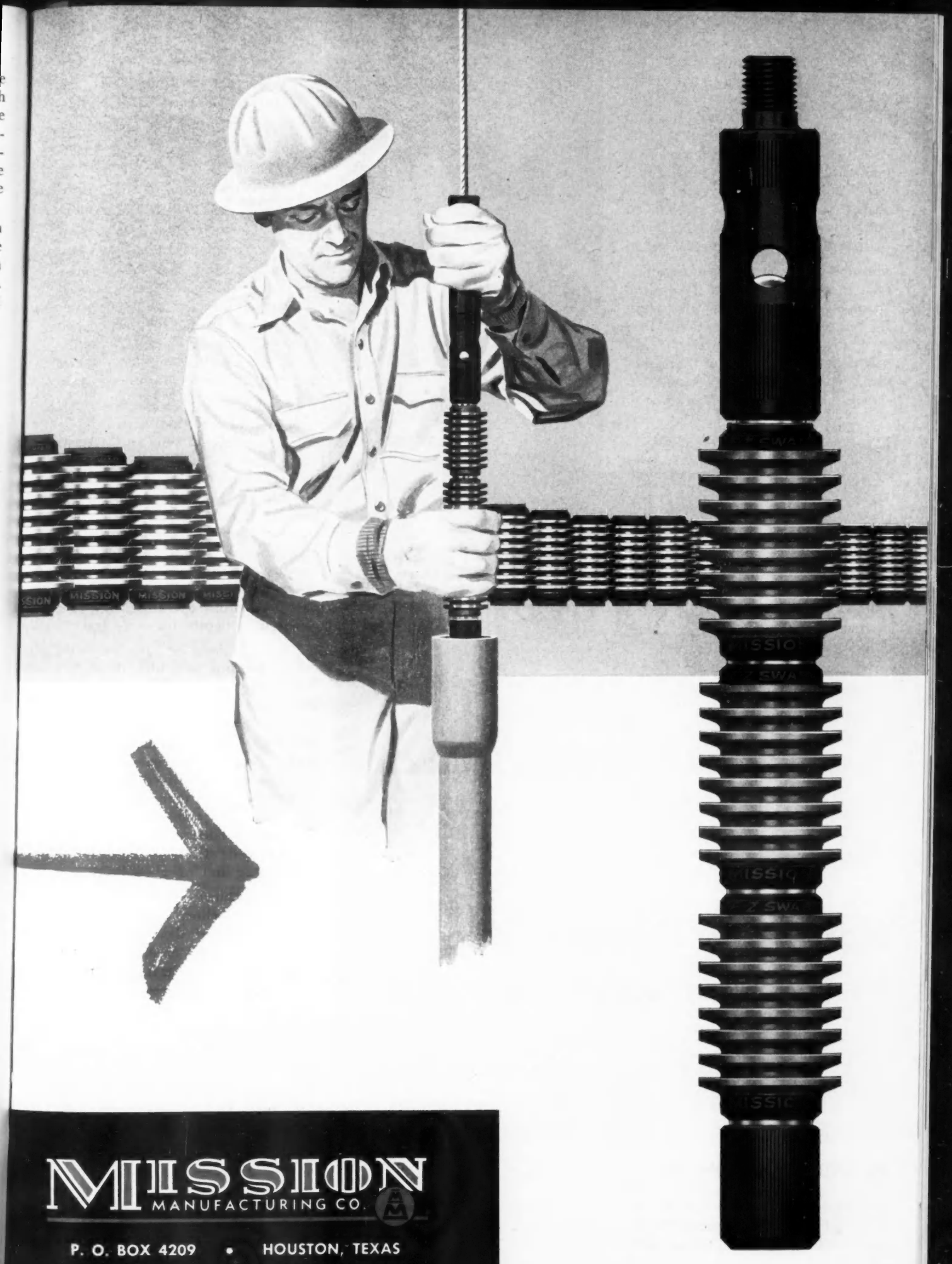
—**The End**



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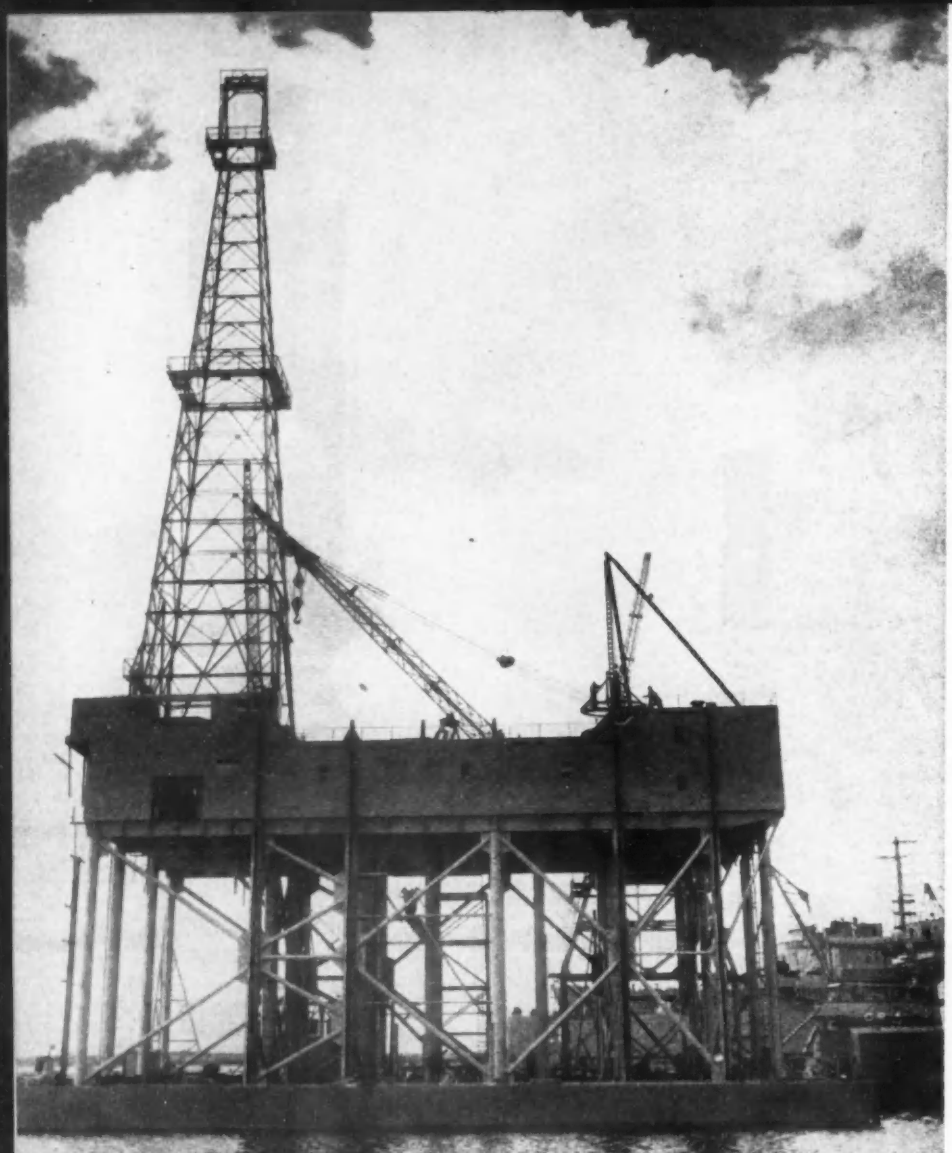


KERMAC RIG 44 designed by Kerr-McKee Oil Industries, Inc., of Oklahoma City and built by Ingalls Shipbuilding Corporation in its Pascagoula, Miss., yard. This latest submersible drilling barge is capable of drilling to 16,000 feet in 40 feet of water and can withstand wind velocity of 100 miles per hour.

Here's the Newest 'Ship' In the Petroleum 'Navy'

Kerr-McGee's $2 million drilling barge can drill to 16,000 feet in 40-foot water.

By ANTHONY GIBBON, World Oil Staff

Kerr-McGee Oil Industries, Inc., of Oklahoma City, pioneers in offshore drilling and credited with the first commercial oil discovery in the open waters of the Gulf of Mexico off the coast of Louisiana, recently commissioned their Kermac Rig 44, a $2 million offshore submersible mobile drilling platform capable of drilling to 16,000 feet under tidelands waters as much as 40 feet deep.

This newest "ship" in the "petroleum navy" is a self-contained unit. Within its mobile hull and deck it carries a complete drilling rig, supporting auxiliaries and crews' quarters. Ample storage has been provided for expendibles such as mud materials, cement, casing, fuel, water, and operating supplies in such quantities as to provide for continuous operation of the platform in offshore water.

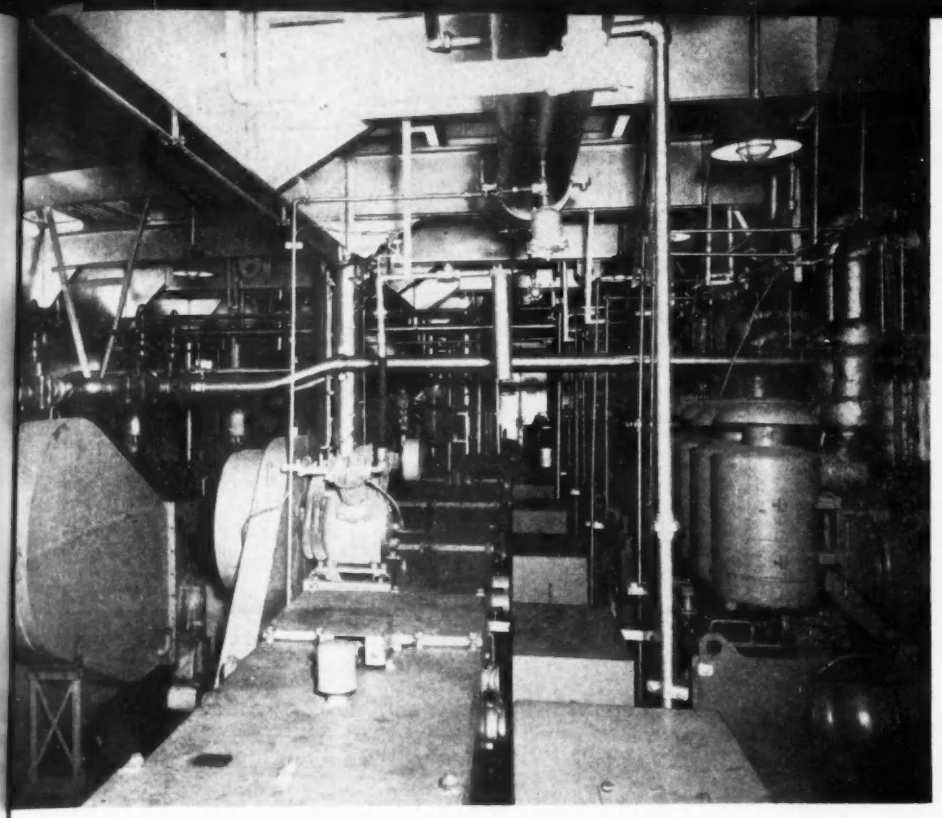
The hull is 140 feet long by 72 feet wide and 13 feet deep. This bottom hull is flooded and sunk to the ocean floor when the platform reaches a drilling location. Pontoons alongside the hull are a special feature of the Kermac Rig 44, designed and built especially for this platform from the experience the company gained with Kermac Rig 40, another submersible drilling platform which Kermac has been successfully operating since 1950 in water of depths up to 24 feet.

These pontoons are attached to the main platform and hull through a slot and hydraulic ram arrangement. As the main hull is flooded and lowered, the pontoons maintain stability. When the main hull has reached the ocean floor the pontoons are flooded and hydraulically driven down to the ocean floor and there embedded in the mud. The combination of pontoons and flooded main hull thus provide needed stability, both while submerging and when on location.

The machinery deck is 60½ feet above the baseline. Within the lower hull are stowed diesel oil, potable water, drilling water and salt water ballast. Located in the hull are pumps, valves and piping necessary to transfer the liquid stores to the machinery deck above.

Rig 44 boasts a unique arrangement of drilling equipment to satisfy the requirement of a short wide slot (24 feet wide by 30 feet long) for offshore drilling.

The 147-foot derrick is mounted on the forward end of the superstructure with the "V" door facing aft. Pipe racks are located above the machinery level between the derrick floor and the quarters.



MACHINERY DECK of Kermac Rig 44 showing diesel engines which drive hoist, pumps and rotary unit; four-engine compound and mud and water lines. Engines are capable of transmitting 2000 horsepower to drawworks and main slush pumps.

of drilling engineers. John Hayward of Tulsa, formerly with the old Barnsdall Oil Company, and a pioneer in offshore drilling barge installations, was consultant. Hoyt Taylor, Kermac's head Gulf Coast drilling engineer, supervised construction. The drilling platform was constructed by the Ingalls Shipbuilding Corporation in its Pascagoula, Miss., shipyards.

Shakedown operations of the new craft will be the drilling of two wells with the Union Oil Company of California in Bretton Sound off the Louisiana coast. Should there be any defect in the design of the equipment company officials expect them to become known during these operations.

By operating in water of depths up to 40 feet deep and capable of withstanding winds of 100 miles per hour, Kermac Rig 44 will open for economical development a much broader horizon of the continental shelf. —**The End**

Two thousand horsepower is transmitted to the drawworks and main slush pumps through a four engine compound located on the machinery deck. The driller's console and the independent catworks, coring reel, and rotary drive are located on the derrick floor.

A two-story quarters section occupies the deck on the opposite end from the derrick, providing comfortable air-conditioned living space to accommodate over 40 men. The lower floor of the quarters is given over to sleeping rooms; the upper level includes the galley, mess room, galley stores, toolpusher's room and office and room for extra personnel.

Complementary equipment has been installed to provide usual available service facilities such as high pressure cementing units, electric logging units and drilling mud control.

The new submersible drilling barge is the equivalent of a nine-story building in height and contains 1800 tons of steel.

Rig 44 was designed by Kermac's chief marine engineer, Paul Wolff, with the assistance of Kermac's staff

PRINCIPALS AT THE COMMISSIONING of Kermac Rig 44 during christening ceremonies at Ingalls Shipbuilding Corporation yards at Pascagoula, Miss. Left to right: W. R. Guest, executive vice-president for Ingalls; D. A. McGee, president, Kerr-McGee Oil Industries, Inc.; Mrs. William Baxter, sponsor and wife of Kermac's division drilling superintendent at Morgan City, La.; Senator Robert S. Kerr of Oklahoma and chairman of the board, Kerr-McGee Oil Industries, Inc.; Monro B. Lanier, president of Ingalls Shipbuilding Corporation.

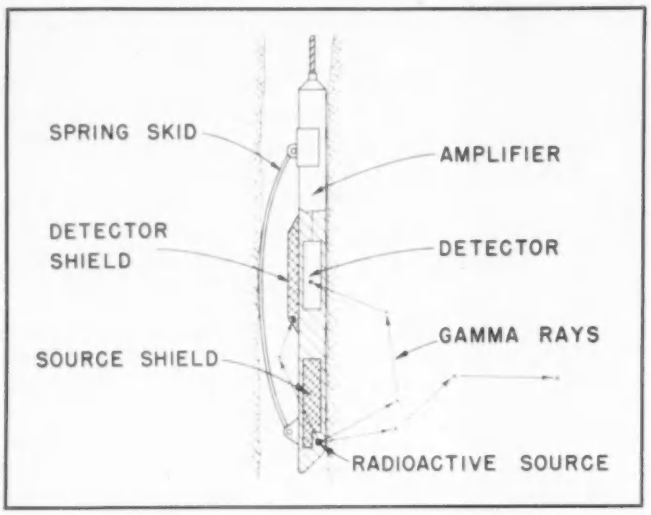


FIGURE 1

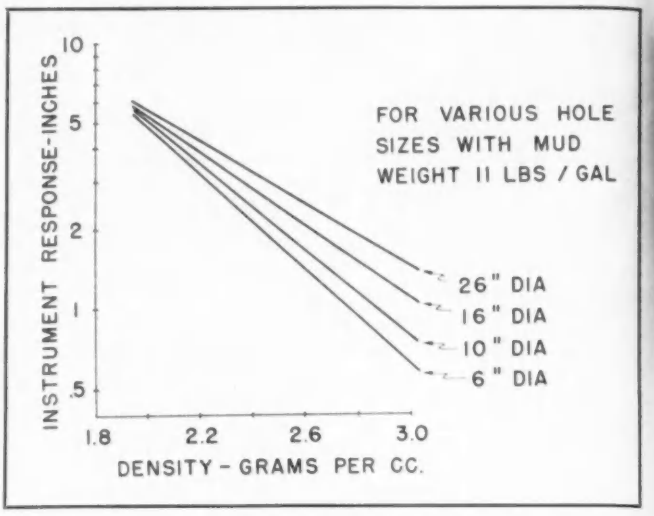


Fig. 2—Instrument response vs. density.

New Logging Technique Measures Density, Porosity

Here's a new tool for correlating subsurface formations. It gives the geologist and production engineer vital information for well completion decisions.

A NEW WELL LOGGING instrument, termed "a density logger" has been developed by the Research Department of the Stanolind Oil and Gas Company, Tulsa. This new instrument will measure the density and porosity of subsurface formations in place. The density of subsurface rocks is important information to the geophysicists who interpret gravity meter surveys. This information cannot be obtained from any other type of well log now available. This log gives the geologist a new tool for correlating subsurface formations, and gives the production engineer additional information for use in well completion decisions. Porosity values obtained from the density log can be used for oil reserve calculations.

This new logging development makes use of the principles of radioactivity but differs from the gamma ray logs and neutron logs which have already gained wide acceptance in the industry. It utilizes the scattering and absorption of gamma rays as the operating principle of the method. The density logging instrument bombards the formations with gamma rays from a piece of cobalt wire which has been made artificially radioactive by the Atomic Energy Commission in the Oak Ridge pile.

Most of the gamma radiation is entirely absorbed by the rocks but some of it is scattered back to the logging instrument where it is measured by a gamma ray detector, as shown in Figure 1. A shield is used around the radio-cobalt source to channel the gamma radiation out into the formations and away from the bore hole. Another shield is used at the detector to absorb those gamma rays that travel from the source directly through the bore hole fluid to the detector.

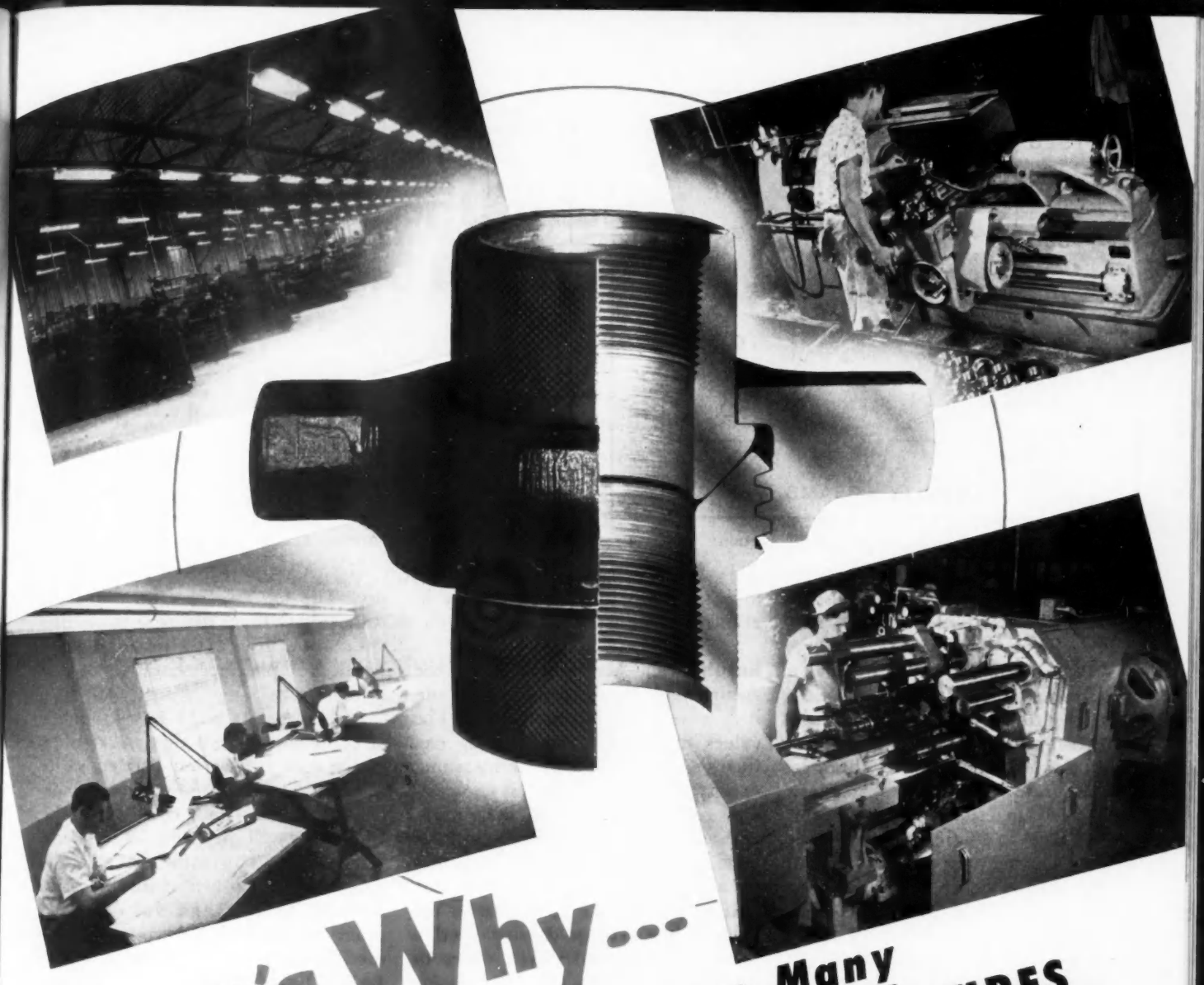
To help direct the radiation into the formations, the entire logging instrument is held against the side of the hole by a spring skid. Because close contact between the instrument and the rock face is necessary for accurate density measurements, the densities are logged only in the uncased portion of a well.

The gamma ray detector and the associated electronic circuits used for sending the signals up the logging cable are similar to those used with other radioactive logging devices.

Procedure. The amount of gamma radiation which reaches the detector is inversely related to the density of the rocks through which it passes. Typical calibration curves are shown in Figure 2 where the deflection of the recorder pen on the chart is plotted against the formation density.

Some of the radiation reaching the gamma ray detector comes up through the fluid in the hole in spite of the shields around the radioactive source and detector. The measured intensity of this undesired radiation is a function of both hole size and drilling mud weight. To correct for this effect, separate calibration curves are made for various hole sizes.

The calibration is done in model wells where the size of the hole and the density of the surrounding rock



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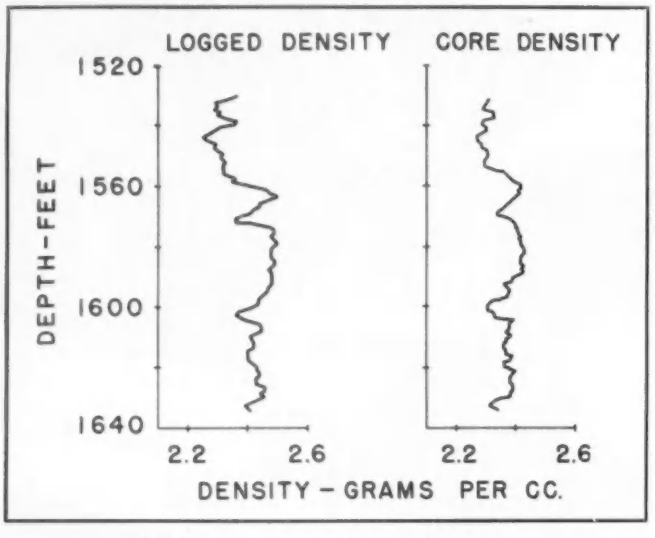

Fig. 3—Well B, Annona Chalk Section.

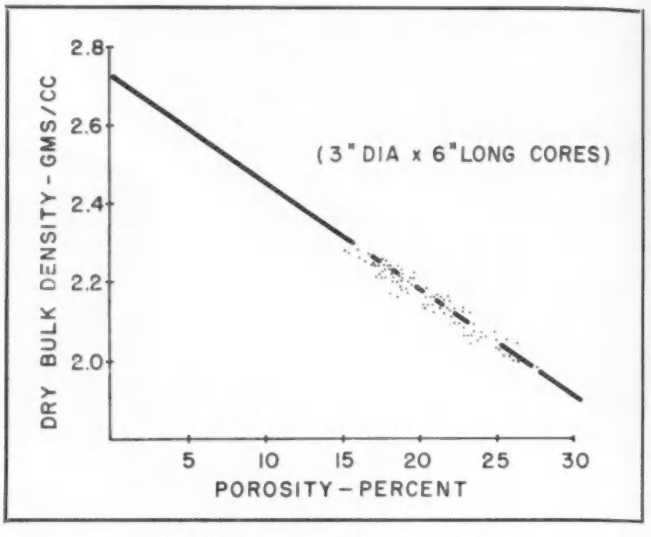

Fig. 4—Annona Chalk Core Data.

are accurately known. The instrument is also calibrated for various mud weights.

Before running the density log, a sample of the well fluid is weighed. If it is a drilling well, the mud weight is taken during circulation just before the tools are removed from the hole. For accurate work it is best to run a caliper log to establish the diameter of the hole at various depths. The density logging tool is then lowered to the desired depth and logged out at a speed of 20 to 50 feet per minute, depending on borehole conditions.

Density values are obtained from the log by use of the calibration curves and the caliper log. First, the proper calibration curve is selected for the mud weight and hole diameter encountered. The deflection is then read in inches from the density log and entered on the calibration curve to obtain the formation density in grams per cc.

Results. The best way to check the accuracy of the density log is to run it in a well that has been cored. The values of density from the log can then be compared with the measured density of the core. For this comparison, core densities are determined with all the pore spaces occupied with water to simulate underground conditions.

It makes little difference in the value of the average density whether the saturating fluid is salt water or oil. Figure 3 shows a density log through a 100-foot section of the Annona Chalk in a well in northwestern Louisiana. This figure also shows the values of the core density for comparison.

On the average the values from the log are 0.04 gram per cc larger than the core densities. The log cannot be expected to always give the same density as the core because the two methods do not measure the same piece of rock. The density of some formations is highly variable.

Experience has shown that if a core is cut in half the two halves will often yield widely different values of density. The log measures a volume of rock larger than the core and may therefore give a value of density which is more representative of the formation.

Measurements on a large number of cores have shown that the density of the rock is inversely related to its porosity. Figure 4 shows the dry bulk density of the chalk cores from the Louisiana well plotted against the porosity of the same cores. The straight line is drawn at zero porosity through the average value of the grain densities of the cores as measured by a U. S. Bureau of Mines Boyle's Law Porosimeter.

The line, if extended, would pass through the 100 percent porosity value at zero density. A similar relationship seems to hold for a wide variety of rock types and formation conditions. The use of this relationship makes it possible to interpret the density log in terms of formation porosity.

Figure 5 shows the porosity log obtained from the density log of the chalk section of the Louisiana well. The values of porosity obtained by large core analysis are also shown for comparison. The log-derived values average 0.75 porosity percent smaller than the core porosities.

Commercial development. The logs shown here were run by the Lane-Wells Company under a licensing agreement using an instrument constructed by them from one of their neutron-logging instruments in accordance with the Stanolind design. A program of evaluation is currently

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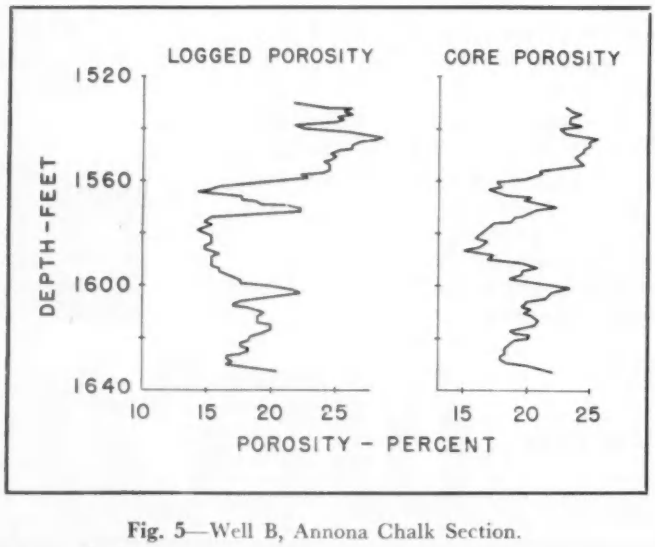

Fig. 5—Well B, Annona Chalk Section.

How Drilling Contractors Can Satisfy the Banker

• Extension of bank credit to drilling contractors requires specialized handling which sometimes is not understood by the contractor.

• Here an oil country banker explains the limiting factors and outlines the basis upon which the contractor can obtain credit to carry on his business.

By EARL L. BEARD, JR., Vice President, National Bank of Tulsa, Tulsa

EXTENSION OF bank credit to drilling contractors requires specialized handling. This is sometimes not understood by contractors who seek such credits. Because of hazards involved in the drilling business, bankers generally have regarded it as being too risky to qualify for temporary loans for working capital purposes, unless such loans are adequately secured by acceptable collateral, or supported by unquestioned balance sheet strength. Some larger drilling contractors are in position to obtain unsecured bank credit based on their past record, their financial statements, and their current operating outlook. The great majority of drilling contractors, however, must arrange credit from banks on some other basis.

Contractors, especially those who own production, know that banks and other financial institutions actively seek oil production loans. But certain contractors who may have experienced difficulty in obtaining loans, do not understand that a specialized technique has been developed for the handling of such loans and that, unfortunately, no such practical and scientific method has been devised for financing the operations of the drilling contractor.

Contract drilling of an oil well differs greatly from other type of general contract work such as building pipe lines, refineries, etc., where definite values are created as the work progresses. The most common form of contract calls for payment when the hole reaches a specified depth. The contractor is not entitled to receive any payment until the footage called for is actually completed. An incomplete hole in the ground is of practically no value. It is, in fact, a liability as it must be plugged and abandoned. The fact that any hole started may never be finished for any one of a multiple of reasons, and the fact that competition in the drilling business compels contractors to accept work on a footage or completion basis, continue to complicate the picture in so far as bank financing is concerned.

Too Much Risk. A frequent occurrence in the oil country is for a newcomer to the drilling business to apply for a bank loan to help pay for his rig. Having been assured of contract work for the rig, and being in position to make a substantial payment from his own resources, the contractor assumes that his bank should be willing to advance the balance of the purchase price and take a chattel mortgage on the equipment.

Such loans involve too much risk and such financing properly should be negotiated by the seller of the rig who has a profit margin to serve as a cushion for losses, and who will benefit from the sale of operating equipment to the contractor.

There are some exceptions. If the rig is assured of a definite amount of work at day work rates, rather than on a completion or turnkey basis, an assignment of funds due and to become due may be made and an equipment mortgage may be taken as supplemental collateral. Another instance would be where the contractor has accumulated several rigs, and has acquired sufficient net worth to justify the credit requested. In either instance the source of repayment would be clearly indicated.

Any bank operating in an oil-producing area will, in time, receive requests to make a wide variety of loans for various purposes to drilling contractors. They may include:

- Unsecured loans for working capital purposes.
- Term loans for equipment purchases.
- Loans for the development of oil properties.
- Loans on equipment regularly employed under definite contract.
- Working capital loans secured by chattel mortgages on equipment.
- Loans on work in progress.
- Loans secured by assignment of funds due from completed contracts.

Of the above, the three types of loans most attractive to the banker are: unsecured loans, which of course, must be adequately supported by financial statement strength; oil property development loans, which will be repaid from the sale of oil produced; and loans against completed and invoiced work. These loans are relatively easy to handle because the source from which they will be repaid may be clearly seen.

Many contractors seek loans on their equipment and it may serve to clarify the situation if a brief statement is made here as to why such

loans involving equipment mortgages, and loans which must be repaid from completion work in progress are most troublesome and hazardous, from the banking standpoint.

Drilling equipment generally is not considered desirable collateral for bank credit. It is often taken as additional security to provide for better control, and to prevent the possibility of a contractor complicating the picture by borrowing elsewhere. Credit extended a drilling contractor on equipment may result in trouble for the lending agency in the event of foreclosure.

A drilling rig not in use is in reality a liability. Depreciation continues whether the rig is working or idle, and a substantial amount of capital is tied up. There is nearly always a surplus of available drilling rigs in the country, for a normal condition calls for approximately one-third of all available rigs to be idle. When drilling programs are curtailed and more rigs are inactive, it is very difficult to sell them at even a fraction of replacement value.

Additional objectionable factors in equipment loans may be summarized as follows:

- The generosity of contractors in lending tools often leads to lost, misplaced, and forgotten pieces of costly equipment.
- When "stacked," tools must be closely watched at all times. Certain parts have a tendency to disappear.
- Equipment is subjected to hard usage which soon reduces it to junk, with only salvage value.
- Operating hazards encountered may cause losses against which the contractor has not properly indemnified himself.
- It is difficult to exercise much supervision over a working rig—it moves into different counties and states, and certain parts, such as motors and pumps, are continually being replaced.
- Since self-propelled, truck-mounted equipment may be subject to both motor vehicle and chattel mortgage laws, it is difficult for a bank to be certain that it has a valid lien. Varying state laws necessitate expert legal counsel.

About the Author

EARL L. BEARD, JR., a native Oklahoman, began his banking career in 1930 with the National Bank of Tulsa. He has served in several departments, and for ten years was assistant manager of the credit department, where he specialized in loan and credit analysis. At present he is assistant vice president. Beard is past president of the Seventh District National Retail Credit Association. He holds the American Institute of Banking standard certificate and is past president of the Tulsa chapter.

A better understanding may be created between the drilling contractor and his banker if it can be explained why the latter is reluctant to extend credit to carry on the work of completing a well being drilled on a turnkey, or bottom hole basis, if the banker must look to funds due upon completion for repayment of the loan.

In the first instance there is absolutely no assurance that any given well will ever be completed until completion is actually accomplished. Nearness to completion does not alter the risk. Wells may be lost during the last few feet of the project. A blowout, fire or fishing job at the last moment may prove to be so costly as to result in bankruptcy for the contractor. Better equipment and improved methods and practices have helped diminish the possibilities of some of the hazards. Even though the frequency rate of lost holes, blowouts, fire, and other trouble is lower, the fact remains that these hazards are present, and the banker is reluctant to speculate on the likelihood of their occurrence.

Although bank credit to drilling contractors is hedged by restrictions that do not exist where production loans are being considered, this is not to imply that the banker and the drilling contractor cannot do business.

For instance, work in progress under contract negotiated on a day work or progress payment basis may be readily financed if billings for work completed are permitted. In such instances, and provided the credit of the operator is unquestioned, the funds due from the operator may be assigned to a bank as collateral for working capital loans.

In other instances where the risk can be spread, the percentage advanced kept at a conservative figure, and the contractor and his operator are thoroughly reliable, funds may be advanced to help carry on a drilling program. Let us assume that a drilling contractor owns five rigs, and his equipment indebtedness is not heavy. He has five wells in progress under contract. They are being drilled for excellent operators. The wells are in varying stages of completion, but several weeks will be required to complete the first well, and thereafter completions are expected to be made at the rate of one every day two or three weeks.

The contractor has used all available working capital to carry the program to its present status. His supply company bills are due monthly, and payrolls must be met weekly. He now needs funds to proceed with the program and take discounts on accounts payable.

It is hardly likely that he will fail to complete the larger part of the program, even though trouble should develop on one or two of the wells. Under such conditions a loan agreement could be negotiated whereby the contractor would agree to assign the proceeds due from the contracts, as completed, as collateral. The bank could determine a conservative percentage of the total contract price to be advanced, and funds needed could be advanced as the program progresses.

A loan arrangement as outlined above provides necessary working capital for the contractor and at the same time minimizes the risk taken by the financial institution.

Loans secured by assignment of funds due on completed contracts is the most acceptable method used by banks in financing the drilling con-

Continued on Page 156

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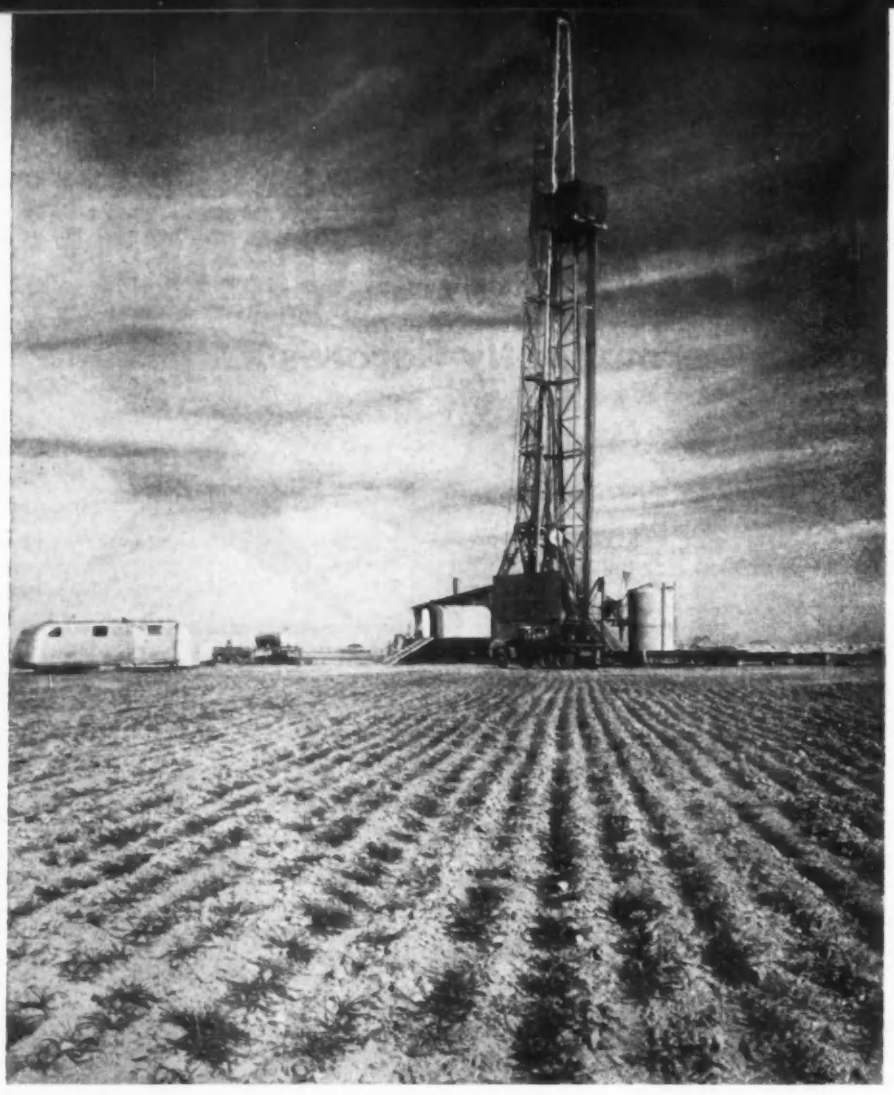


TODAY'S DRILLING RIG looms large against the peaceful Montana sky. Terrain varies from a cultivated field such as this to the rough-and-rugged "breaks" country.

Contractors Are Solving Williston Basin Problems

Here is a roundup of current drilling techniques in the area.

SINCE THE DISCOVERY of oil in the United States portion of the Williston Basin three years ago, some drilling problems have been eliminated, others reduced to standard routine practices, while still others remain unsolved.

One of the most pressing problems in the early days of the play was that of supply. When Amerada's discovery in North Dakota convinced the industry of the importance of the Williston Basin only the city of Casper, Wyo., was available for supplies and services. This supply center had served Rocky Mountain operations and the influx of operators into Basin area strained all its resources. Supply companies, however, believing as did operators, that a vast new oil province was about to be opened, moved ahead and established supply and service centers at strategic points which are now readily accessible.

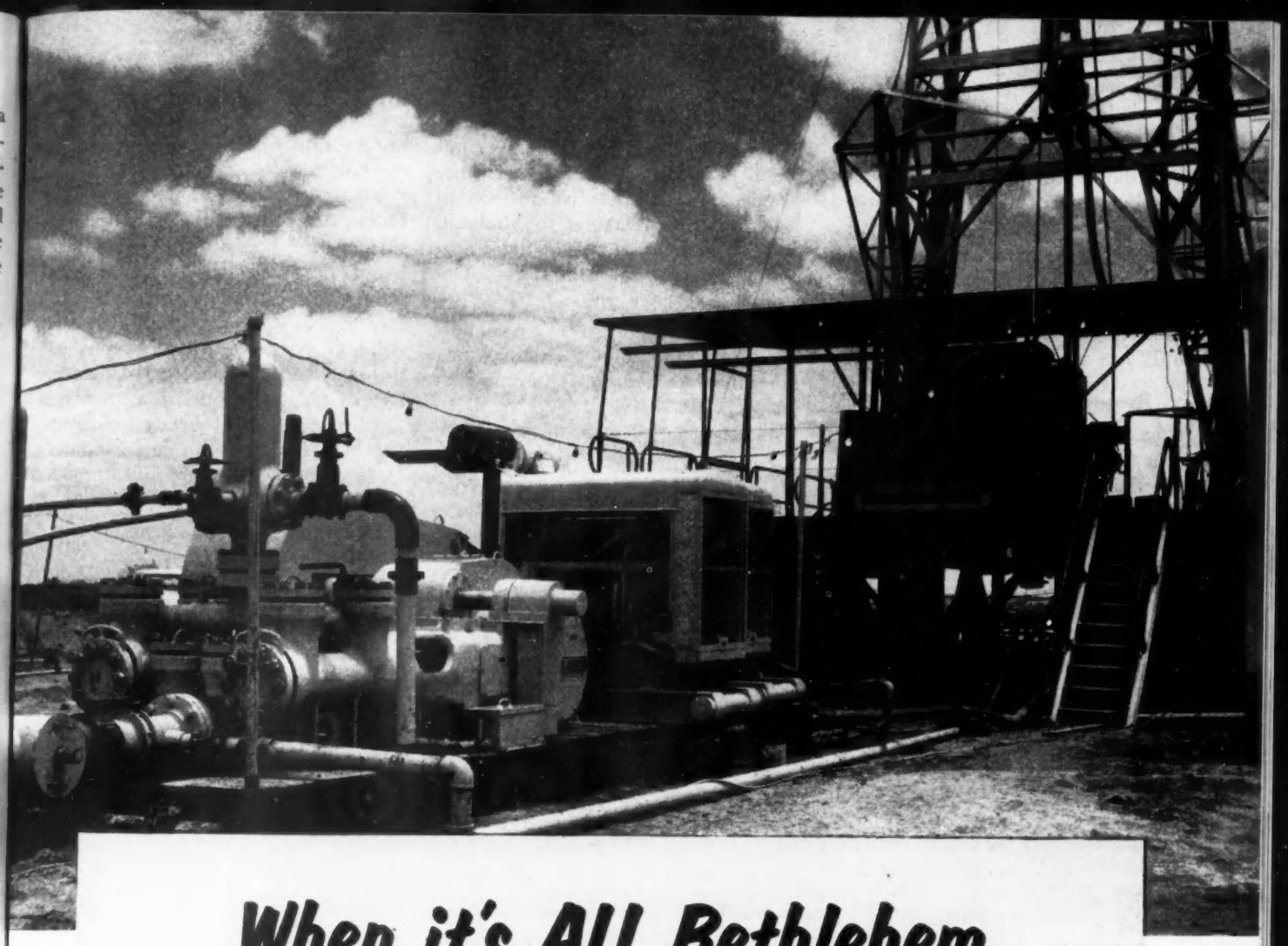
Service is available today from a number of points throughout the area, with Williston and Glendive the focal points. The formidable problem of supplying wells and drilling operations scattered over a region of more than 80,000 square miles within the U. S. portion of the Williston Basin has been overcome. In the process drilling costs and lost time have been reduced considerably.

Cold weather. Drillers were unprepared for the extreme cold encountered in the Williston Basin area during the winter months. However, complete winterizing of equipment, steam tracing of lead lines, and adaptation of techniques developed in other frigid areas, has about licked the climatic problem. Drilling firms, operators and service firms have also adjusted to the rather stringent highway limits made necessary at certain times of the year because of icy or thawing conditions.

Mud engineers have made great strides in solving drilling mud problems peculiar to the basin and procedures have become more or less standard. So has logging, in many respects.

With experience, time consumed in coring and testing has been reduced greatly thus reducing drilling costs. Completion itself, and the detection of possible shows during drilling in zones which might "unexpectedly" contain oil, are still problems which have not been solved.

Political problem. Besides technical and engineering, there is what may be termed the "political" problem which engage the attention of contractor and operator alike. In Montana, confusion resulting from a recent attempt to have lease life extended to the life of production has halted drilling activities on state lands during the past year and a half. Montana state regulations formerly provided 20-year life, even for producing leases. The 1953 legislature passed an Act elimi-



When it's ALL Bethlehem ...it's ALL Dependable

Whenever a customer describes his Bethlehem rig as "dependable"—that's the highest praise he can give us. For all our years of research, all the engineering at our command, all the production steps in our shops are directed toward just one end—dependable performance of Bethlehem machines.

It's a comfortable feeling to know that your rig will keep going at 12,000, 15,000, 18,000 feet when the chips are down and the stakes are high. With a rig wholly built and equipped by Bethlehem, you have that assurance, as many an owner will tell you. Every Bethlehem component is a dependable item of equipment. When the rig is all Bethlehem, it's *all* dependable. There are no mismatched elements; everything is in balance, everything precision-engineered.

Bethlehem rigs are fast drillers and they are conservatively rated, with high reserve. But that's not the most important thing. They are dependable under any conditions of operation; that *is* the most important thing.

So, make it Bethlehem from crown block to the bottom of the hole. No matter what sort of drilling you do—shallow, medium, deep—there are Bethlehem drawworks, slush pumps, swivels, rotary tables and everything else for your particular set-up. Ask for complete details; we'll gladly spend all the hours or days you want, talking it over with you.

In addition to drilling equipment and a full range of pumping units, Bethlehem offers Beth-Co-Weld line pipe, Purple Strand wire rope, and a complete variety of sucker rods, fasteners, etc. Ask for these reliable products when equipping your oil-country installations.

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nating the necessity of auctioning leases at the end of 20 years, and establishing the life of a production lease in accordance with standard practice elsewhere.

This act was held unconstitutional and is now the subject of litigation. In the meantime drilling on state lands, or on blocks containing state lands, has stopped. This situation has retarded drilling in Montana and concentrated operations in North Dakota. It has caused some drilling equipment to move to Canada. The retarding effect of this political situation is easily understood when it is remembered that Sections 16 and 36 in each township are normally state lands and that exploration is usually conducted by big block operations.

Over the past two years drilling on the Montana side of the basin has included some development work along the Cedar Creek anticline and a considerable amount of exploratory work to the north and east of these areas. Recently a considerable amount of emphasis has been placed on drilling in the deeper portion of the Basin east of the anticline. Discoveries have resulted at Brorson in Richland county, and in the Wibaux area of Wibaux county.

The Brorson discovery was in Ordovician, with production from 12,585-12,605 feet. A second well in this area is being completed in the Madison at 9128-9220 feet.

The first well in this area had shows in Madison, but these were not thoroughly tested.

The Wibaux county discovery is being completed by Lion Oil, with production in Red River (Ordovician) below 11,000 feet. The establishment of Madison production through this area will result in increased drilling to shallower prospects.

Other work in eastern Montana has included wildcatting in the northeastern corner, where several wells in Daniels and Sheridan counties have found shows in formations too hard and tight for production.

Typical drilling in Montana will require up to 60 days on bottom for completion of a 10,000-foot well. Fairly rapid progress is made to the Dakota (Cretaceous) at from 3000 to 6500 feet. Below this formation progress is slowed somewhat. Penetration of this formation is generally completed in under 10 days.

To the Dakota, drilling weights of 3 to 10 tons are the rule. General practice finds the weights in the heavier range. Weights will increase to 9-15 tons from Dakotas to Madison, and will increase again in the 10-to-20-ton range from Madison to Devonian or Ordovician.

Rotary speeds are in the neighborhood of 100-130 revolutions per minute through the Dakota, and decrease to 60-75 rpm from the Madison on down.

Drilling through the Dakota is with high mud volumes and velocities. Pump pressures stay customarily in the 400-900 pounds per square inch range through this formation. Below this depth they will increase to 750-1000 or better.

Mud used from surface to Lower Jurassic is native, a product of the bentonitic shales encountered, with some caustic and quebracho treatment. Below this depth anhydrites and salts commonly encountered necessitate the use of salt base muds. Gyp-base muds with starch additives have also been found effective in reducing caving and sloughing which have been major problems of the area.

Mud weights in the neighborhood of 9 to 10 pounds per gallon are maintained above the change-over point. Viscosity is in the 38-50 seconds range.

After conversion, weight will run 9.5-10.5 pounds per gallon, with viscosity increased to 45-60 seconds. Water loss is held to 5-12 cubic centimeters.

There has been no percentage reduction in exploratory drilling on the Montana side of the basin, with the result that maintenance of mud characteristics over long periods still adds to the costs and problems of drilling.

Typical casing program in Montana will call for 10¾-inch surface pipe to 500-800 feet with about 750-1000 sacks of cement. Long string is generally 5½-inch, set with about 600 sacks. In the deep prospects of eastern Montana where it is desired to protect the Madison zone while going ahead to Ordovician or other deeper formations, an intermediate string of 9⅝-inch pipe is set through the formation.

Logging programs usually include conventional techniques in the upper formations, with micrologs, laterologs, limestone surveys, and gamma-ray neutron surveys in all or part of the hole.

North Dakota. On the North Dakota side of the basin, drilling in the Beaver Lodge-Tioga areas has been reduced fairly well to standard. Surface pipe is set to about 600 feet, and either 5½ or 7-inch casing is set through the pay zone at completion. Deeper wells (Devonian) in this area call for a 17½-inch surface hole, with 9⅝-inch pipe set through Madison. Drilling below this depth is usually with an 8⅝-inch bit.

Only one really significant innovation has been made in this area during development. The use of jet bits with rather high pump pressures (1100 psi) has reduced bit expenditures, and shortened on-bottom time. Number of bits used has been cut as much as 8-10 units in Mission Canyon (Madison) wells by use of jet bits.

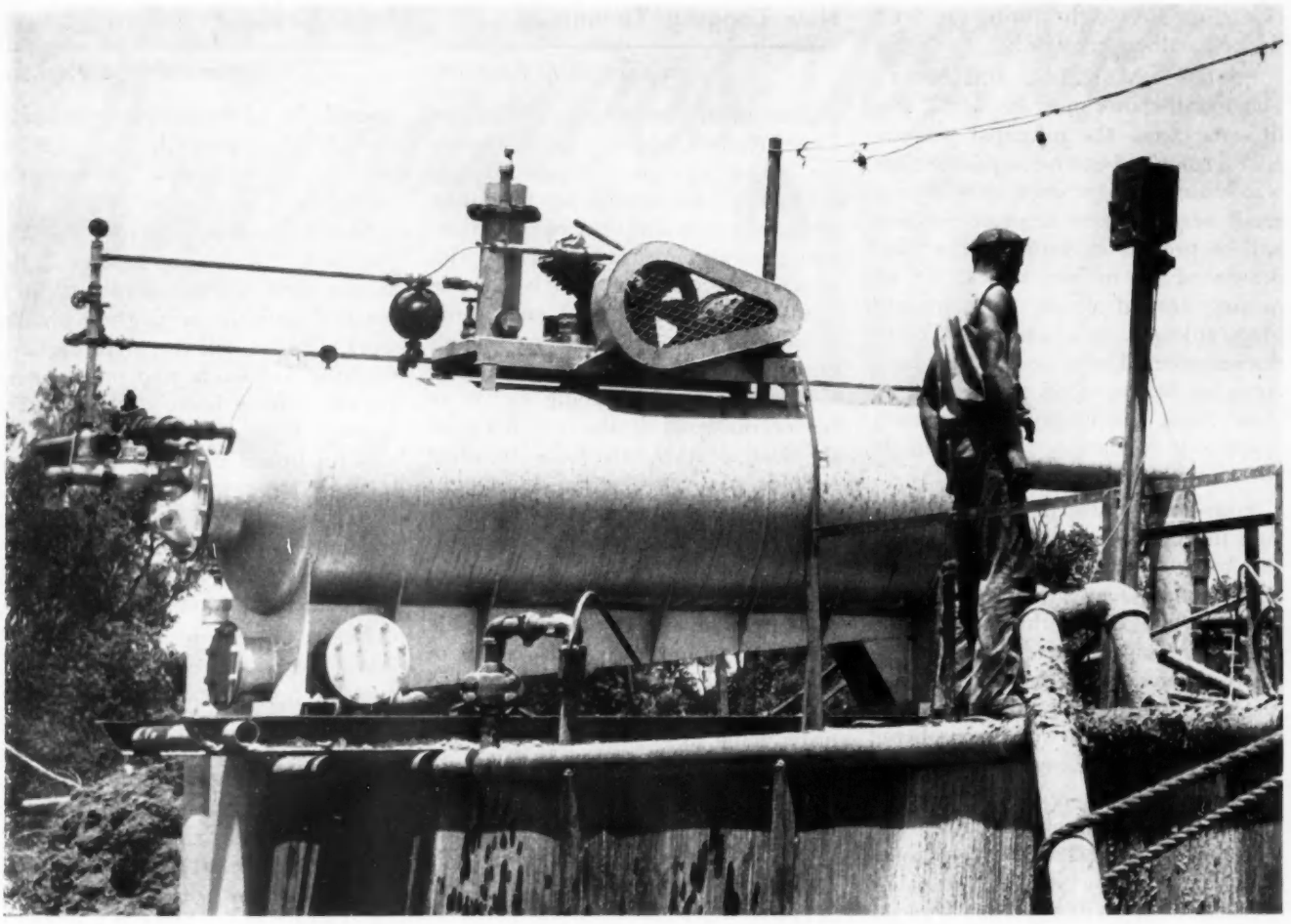
Weight on bits is approximately the same as that outlined for Montana, with the range possibly a little higher. Pump pressures are also about the same, and mud programs are generally similar, although some changes are necessary as between the northwestern North Dakota area and the varying conditions in scattered Montana drilling.

Surveys include microlog and gamma ray-neutron, enabling the best determination of porosity zones in the Mission Canyon when used in conjunction with conventional logs.

Coring programs which accounted for so much of the early cost of drilling in the Williston Basin have been reduced to a comparative minimum in North Dakota drilling. Much of the exploratory and semi-exploratory work of Eastern Montana still requires the cutting of extensive cores, however.

Three or four cores per well in the development drilling of North Dakota is the rule. However, in this general area an exploratory well will cut cores equivalent to those in the very early drilling in the Beaver Lodge-Tioga areas.

Completions have been effected in North Dakota at Fryburg in Billings County in both the Madison and in the Minnelusa zones. Drilling conditions are very similar to those farther north. A high-pressure gas zone in the Dakota required a considerable in-



How this mud D-Gasser saved the day for a Gulf Coast Operator*

While drilling near Bay City, Texas, an operator encountered a high pressure salt water flow that caused the mud to become very thick and gas-cut. Weight material was added but with little success—the well soon blew out.

For three days, the operator tried to weight up properly, but due to the frothy, flocculated condition, he could not balance the force for fear the overburden pressure would be exceeded and circulation would be lost. This is another serious problem in this area.

SOLUTION

A phone call—in a few hours:

A Salt Water Control, Inc., Total Mud D-Gasser was treating all the mud from the well, completely removing entrained gas responsible for the frothy mud. The mud was soon returned to normal condition, the well was brought under control and drilling resumed.

The operator could then control the mud weight to a few tenths of a pound, and the danger of entrained gas was gone. The operator figures the total rental on the D-Gasser was more than saved the first day it was in use.

When you have or expect to have a serious gas problem like the one described here, we can help you quickly—just phone us. We have handled similar problems on over 300 risky holes in the last two years!

Write us for field results and descriptive information. The Total Mud D-Gasser is for rent or lease, only.

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TE-6303	56610			
	83414			

crease in mud weight during the drilling of the discovery well.

Both in Montana and North Dakota all shows must be tested, and in some areas the principal porosity is of a fractured nature requiring close watch on samples since only a very small percentage of fracture surfaces will be present in samples. The high gravity of the oil also is a factor requiring careful watch by mud logging, solvent cut, and check for fluorescence. These procedures have come to be regarded as essential in those areas where very little primary porosity is encountered in potentially productive formations.

Four-hour drillstem tests are the rule throughout the U. S. portion of the basin. Some geologists condemn the practice of rejection of a zone of 100 feet or more in thickness on the basis of a drillstem test. Possibly productive zones of 30 feet or less may well exist within such an interval with separation from salt water zones being only a very thin impervious layer.

Completion in porosity zones of varying nature, thickness, and relationships to the water bearing zones above and below is today a major problem in the Williston Basin. Acidizing of wells to increase production, almost a routine procedure, sometimes further complicates completions. The almost universal practice is to set through, perforate with shaped charges or conventional bullets or both, then acidize through perforations. According to some operators in the area, a considerable amount of trouble has been encountered by pressure build-up which breaks down cement, allowing acid to escape up or down the hole into water bearing or more permeable zones.

Drilling both to the deeper zones and to the Madison will increase in Eastern Montana in the near future. Exploratory work in North Dakota will be concentrated in the southwestern part of the state, and on the eastern rim of the basin where stratigraphic production is sought. The success of these programs will determine the pace of activity and further development in the entire basin.

Meanwhile, a majority of the technical problems of drilling in the area have been reduced as nearly to formula as those of most major oil provinces.—**The End**

New Logging Technique

Continued from Page 144

underway in cooperation with the Lane-Wells Company to determine the adequacy of this new logging technique for measuring formation densities under a variety of conditions and to determine the precision with which rock porosities can be logged. Under this program a substantial amount of core data is being accumulated for comparison with the logs.

The greatest disturbing factor so far encountered is the roughness of the wall of the bore hole. In those sections of a well where the roughness of the wall prevents the instrument from making good contact with the face of the formations, a portion of the well fluid is included in the measurement and the resulting value of density is too low. Such regions of inaccuracy can usually be recognized from the caliper log. Several methods of reducing this disturbance are being investigated. Even in very rough wells, however, the reproducibility of a log on repeated runs is very good.

The use of the scattered-gamma-ray density logger provides a means for obtaining information on the densities of subsurface formations that otherwise can be provided only by measurements made on drill-bit cuttings while a well is being drilled, or by measurements of rock cores taken during the drilling process. The main advantages of the density logger over these other methods are:

1. The densities measured are those of the rock under subsurface conditions.

2. The densities obtained represent a measurement over a considerable volume of rock adjacent to the bore hole rather than from a series of relatively small samples taken from the hole.

3. The density log is immediately available, and thus may be used for well completion purposes.

Even at its present stage of development, the density logging instrument shows the promise of great usefulness in geophysical gravity-interpretation work, and of becoming the most accurate quantitative method available for determining subsurface formation porosities in place.

ACKNOWLEDGMENT

The new well logging instrument discussed in the above article was fully described at the Annual Meeting of the Society of Exploration Geophysicists at St. Louis.

—**The End**

Bank Credit Problems

Continued from Page 150

tractor. It provides the contractor with funds during the interim between invoicing and actual receipt of payment.

Many contracts permit the contractor to invoice for footage drilled at the time when contract depth is reached and the well goes on day work. Others call for invoicing after footage, day work, and other special services have been performed. The average time required by oil companies for processing invoices, and payment of the amounts due, is from 45 to 60 days. Invoices rendered in accordance with contract terms are regarded as being a proper basis for loans during this period.

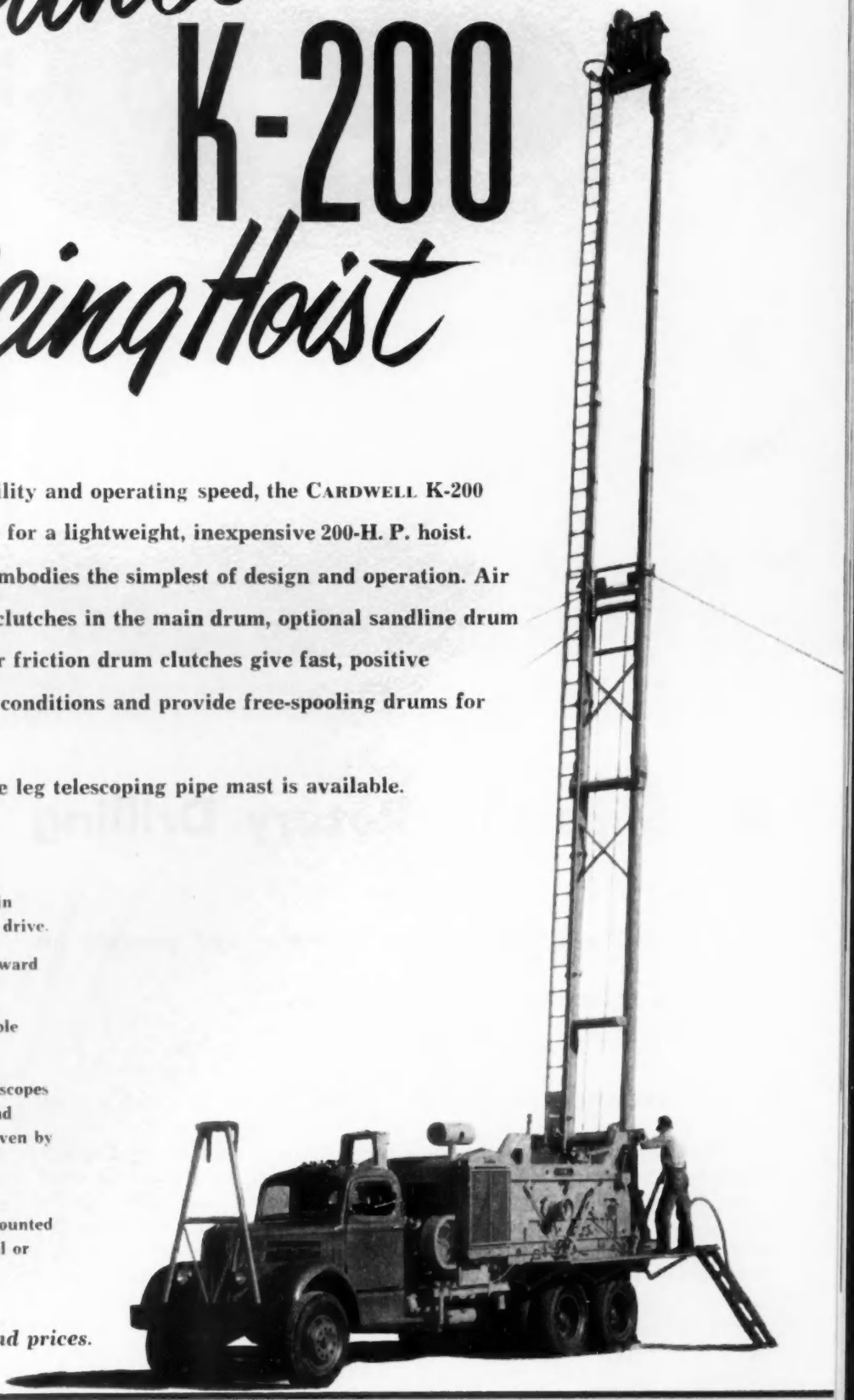
Loans on this basis are very similar to any other type of accounts receivable financing. The principles are the same. The borrower must be of excellent character, he must have demonstrated capacity to perform the work undertaken in a satisfactory manner; and the operator, who must ultimately provide the funds with which to repay the loans, must have an unquestioned credit record. If, after careful investigation and appraisal, a contractor's request for credit on this basis is approved, a definite procedure is established by the bank for handling the account.

In conclusion it can be said that the primary consideration in any loan to a drilling contractor is proper appraisal of the man. His record, background, character, and ability are of vital interest to lending institutions which are anxious to support those engaged in this important phase of the petroleum industry. The contract drilling business is certainly not for weaklings. Only the strong survive.

From the banker's standpoint he must bear in mind that only a fraction of the potential oil-producing area of the U. S. has been explored. As new areas are opened, more bankers will be given opportunities to serve the drilling industry. When properly handled, loans to drilling contractors not only provide suitable employment of bank funds, but help also in developing one of our most important natural resources.

—**The End**

CARDWELL Announces the New K-200 Servicing Hoist



Designed for utmost mobility and operating speed, the CARDWELL K-200 servicing hoist meets your needs for a lightweight, inexpensive 200-H. P. hoist.

The design of the K-200 embodies the simplest of design and operation. Air controls operate the air friction clutches in the main drum, optional sandline drum and rotary drive. CARDWELL air friction drum clutches give fast, positive engagement under all operating conditions and provide free-spooling drums for fast dropping of the block.

A 65-foot or 55-foot double leg telescoping pipe mast is available.

FEATURES

CARDWELL air friction clutches in main drum, optional sandline drum and rotary drive.

Transmission provides four-speeds forward and one reverse to both drums.

Free-spooling drums, mounted on double row, self-aligning bearings.

65-foot or 55-foot double leg mast telescopes and folds over the hoist. Mast is raised and extended by line from winch which is driven by truck engine.

K-200 is available with GM 6031-C or Waukesha 145GKU engine, and can be mounted on a WC-2264 White, RF-195 International or 800-Ford truck.

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THERE IS A CARDWELL PARTS STOCK NEAR OR IN EVERY OIL FIELD OF THE WORLD

POWER SLIPS in position for setting. Pipe is moving through slip coming out of the hole, slips lifted. Helmerich & Payne Rig 25 in Yarbrough Allen field, Monahans, Texas.

POWER SLIPS set holding drill collars as they come out of hole.

Air Slips Cut Rotary Drilling Time

They also save on material and provide an important safety factor for the crews.

By J. C. KERNAN, Helmerich & Payne, Inc., Tulsa

AFTER CONTINUOUSLY using air slips for seven years, Helmerich & Payne, Inc., of Tulsa have found that they are an efficient device, saving labor, time and material, particularly when used on rigs of 9000-foot capacity or greater. Air slips also tend to increase safety and reduce fatigue or exposure to danger.

Three different makes have been used continuously for the past few years. At the present time, 12 sets are in operation. Although air slips were first employed for safety and efficiency, they have been found valuable as an economic factor since they may be used for running 5½-inch or smaller casing and tubing as well as for drill pipe. When used for running casing, the slips save the time and expense of large casing spiders. In at least two cases, they have prevented expensive fishing jobs.

The air slips are mounted by means of a bracket which is bolted to the side of the rotary table housing. Once the slips are mounted, they are always in position and require little time or expense when rigging up or tearing down. Only the air supply line and control valve have to be connected or disconnected. If large rigs have air clutches, there is always an adequate air supply without additional cost or equipment.

Advantages of Air Slips—The principal advantage of air slips is that they save time, labor and equipment. The slips are set and released by means of an air control valve which is usually operated by the driller's foot. When making a trip the slips may be set rapidly and the pipe set at the proper level. This helps the floormen in setting and operating the pipe tongs. Furthermore, since the slips are also released or raised by a touch of the driller's foot, the roughnecks do not

Most sincere wishes that yours is a very Merry Christmas . . . and that you enjoy good health and happiness during '55 and the years to come.

THE CONTINENTAL SUPPLY COMPANY

have to bend over and lift the heavy slips out of the rotary table bushing before the pipe may be lowered in the hole.

In this respect air slips tend to accelerate and simplify the operation which reduces trip time and crew fatigue, especially in the heat of the summer. Although reduction in time and fatigue are somewhat hard to calculate, it is believed that the best proof of the "worth" of the air slips is by personal observation. Helmerich and Payne crews have been asked frequently whether or not they prefer air slips—all have been strongly in favor of their use. The principal reason is that crews are not greatly fatigued after making a long trip during hot weather. This is not the case when air slips are not used.

Reduced Wear on Drill Pipe. Air slips tend to reduce wear on drill pipe particularly when the slips are built with a bowl as part of the slip assembly. The bowl properly positions the slips around the pipe, thus saving wear on the rotary bushing and bottlenecking of the pipe. Furthermore, since the slips cannot be set in advance, as is frequently the case with hand slips when coming out of the hole, the slips cannot override the tool joints which cause wear on the tool joints and slip dogs.

Safety Important Advantage. So far as safety is concerned, the air slips, if properly mounted so that the supporting member cannot be lowered upon a man's foot, materially reduces the amount of exposure of limbs during trips. Improper mounting has caused injuries, but this factor can be controlled. In addition to exposure, excessive body bending and lifting by roughnecks can be greatly reduced. With reduction in manual labor and the resulting reduction in fatigue, accidents should be reduced considerably.

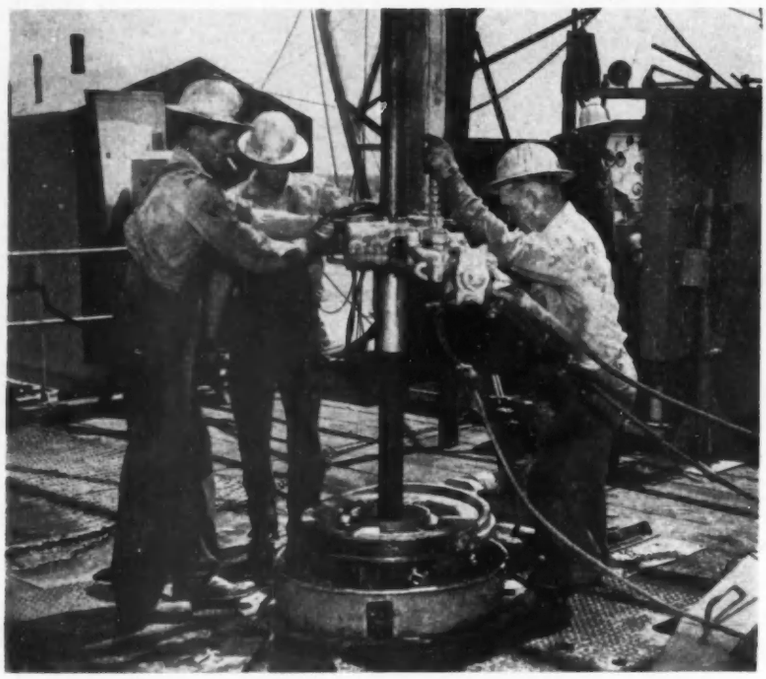
Prevent Fishing Job. In addition to any other advantages, air slips have saved Helmerich and Payne from fishing jobs on at least two occasions. In both instances parts of the suspension equipment failed during a trip. The traveling block and hook fell to the derrick floor, the air slips were set catching the drill pipe and preventing it from falling some distance which would inevitably have corkscrewed the pipe and caused difficult and expensive fishing jobs.

Maintenance is Low. The maintenance cost on air slips is low and operating difficulties are few. One common criticism, particularly by persons not using them is that the air system might freeze in cold weather. Some trouble in this nature has been experienced. However, since most large rigs now use air clutches and many use air catheads and other such devices, the problem is general and not confined to air slips.

The first step in avoiding freezing in the airline is the use of dehydrators to take as much moisture out of the air before it is taken into the air system. The second is to have a trap or drip by which excess moisture in the system may be eliminated. The third step is to put antifreeze in the air volume tank, this vaporizes and circulates through the system and thus prevents freezing in many cases.

—The End

Part 3 of "Keys to Successful Competitive Drilling" by Roy A. Bobo, Robert S. Hoch and George S. Ormsby will appear in a future issue of WORLD OIL. Watch for it!



KELCO Safety Power Slips illustrated in use on H & P Rig No. 25

Helmerich & Payne, Inc. Are 100% Users of KELCO Safety Power Slips!

KELCO slips serve safely and efficiently with low maintenance . . . so well, in fact, that Helmerich & Payne, Inc., (and many other leading drilling contractors) use them **exclusively.**

With their solid slip bowl and low lift travel, KELCO Safety Power Slips can improve performance on your rigs. Find out how KELCO Slips protect your drill pipe . . . and your men.

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Rockwell-Built MUDWONDER Stopped Standpipe Valve Sanding-Up on Falcon Seaboard Rig No. 29

"Our 4 in. MUDWONDER has more than paid for itself with savings in down-time and parts on these last four wells," says Toolpusher E. A. (Blackie) Blackwell, "and it is still working perfectly—holding pressure as well as the day we put it on."

In the Anse Le Bute and Church Point fields where the Falcon-Seaboard Drilling Company Rig No. 29 has been working, sand is often quite a problem. According to "Blackie" de-sanding the standpipe valve at least once every hole and replacing parts was a necessary and costly practice until he bought a MUDWONDER for the standpipe.

Now "four holes" old, the MUDWONDER has required no maintenance and still works easily and positively. Even if it should need a part replacement in the near future, the job can be done quickly and easily. The one-piece MUDWONDER body stays in the line and only one wrench is needed to remove the bonnet.

Is it any wonder that "Blackie" and his crew are convinced MUDWONDER mud valves are best?

On standpipes, jet guns, pump discharges, whatever your troublesome service is you will cut costly down-time and part replacements with competitively-priced MUDWONDER mudline valves. Ask your favorite supplier or use the coupon below for complete details, today.

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How to do it

DRILLING HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

Tractor Used in Cleaning Reserve Pits

After a well has been completed, it is necessary to clean up the location for crop planting and other uses of the surface. Where the mud in the reserve pit is of no value for use in other wells, its disposition becomes a problem. It is often expensive to hire a truck equipped with a vacuum tank to empty the pit.

One contractor uses the bulldozer which does the backfilling to empty the pit. A section of the dike is cut out so that the tractor will pass through and the tractor is run out into the pit with the blade up and then the blade is lowered and the mud is dragged from the pit. A ditch is cut away from the pit on the outside to carry away the mud and in a matter of an hour or two, the entire pit is "sucked" dry by the action of the blade as shown in the illustration.

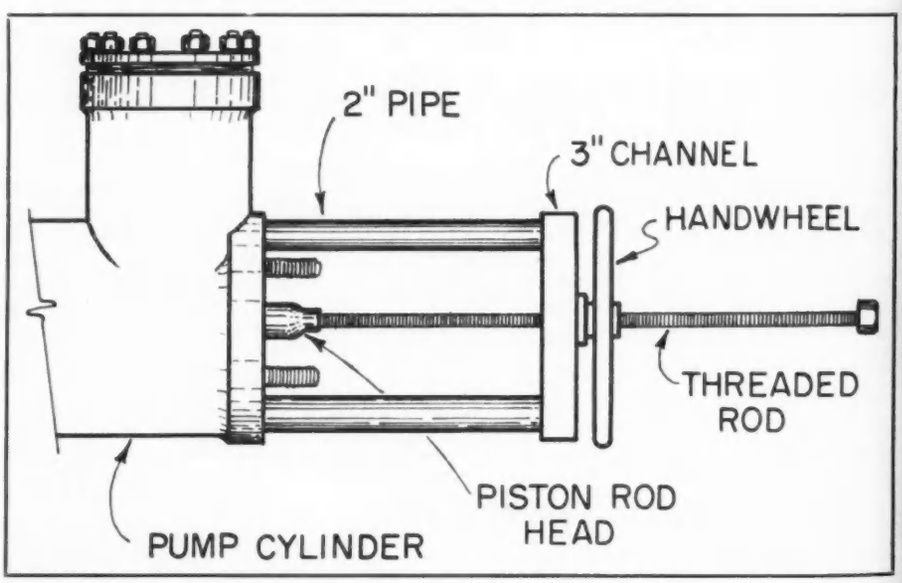
At first the tractor is driven only a few feet into the pit mud to pull the mud back. Toward the end of the job, the tractor has made a flat bottomed groove out into the center of the pit which effectively cleans the pit.

After the pit has been cleaned of the waste drilling mud, the dikes are pushed back into the solid bottom of the pit, leaving the location in nearly the same condition as it was found and making the soil suitable for crops.

Piston Puller Is Simple to Construct

One of WORLD OIL's international readers has suggested a method of fabricating a piston puller to facilitate the removal of pistons. Special adapters make this tool useful in pulling different sized rods.

This tool, which is simple to construct, is made of two-inch pipe which has been welded to three-inch channel iron as shown in the accompanying diagram. The pipe is positioned over the two cylinder studs. A hole is drilled in the center piece of the channel iron to accommodate the long threaded rod, which screws into a special piston rod thread. A thrust race and a distance piece between the channel and the handwheel greatly ease the pulling. Separate heads or an adapter can be added to this tool, making it useful for different sized rods.



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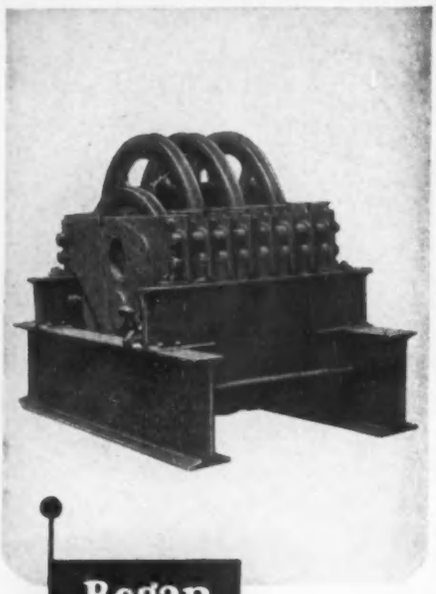

Regan type AN55
CROWN BLOCK

. . . built to stand up under the line speeds and loads applied by the largest drilling rigs. Ball bearings have been used to carry the thrust loads and further reduce the side drag on the sheaves. Heavy roller bearings carry the radial loads. The basic Regan design of a rotating inner race ring has been kept but the inner race ring of the roller bearings is mounted on the sheave hub. A bolt through the sheave hub pre-loads the ball thrust bearings and removes all side play from the sheaves. Positive lubrication to each bearing. Capacity—600 tons. *Write for informative bulletin.*

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Holes in Pipe Adjust Suction Line Height

A simple arrangement for raising or lowering and locking the suction line in place can be made by burning a few holes in a joint of drilling pipe with a welding torch and cutting two bars to fit into the holes. Tongs commonly used for this purpose are more difficult to handle than this arrangement and are more apt to slip and let the suction line fall too low.

Using the standard arrangement with a catline wrapped around the drill pipe which is laid on supports, the tongs are eliminated by having the welder burn six holes in the drill pipe which match with a much larger hole in the plate used for the top of the support. A steel bar is then cut to fit these holes.

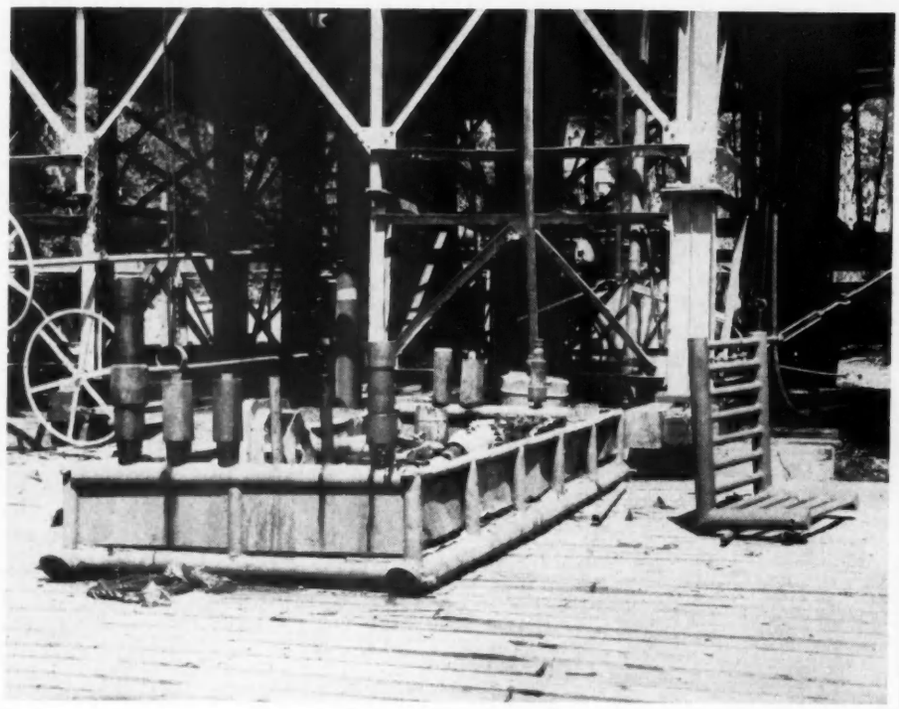
In order to raise and lower the suction line, large holes are cut into the pin end of the drill pipe to admit a crowbar. This longer bar gives plenty of leverage for raising and lowering the drill pipe. The entire adjustment can be done by one man in a few moments, whereas the chain tongs require two men, one for each set of tongs.

Safety Brace on Engine Prevents Hand Injuries

One drilling contractor from Illinois has devised a safety brace which also prevents the hood from vibrating. Frequently, drilling contractors have received small drilling engines without fanguards. On rigs where engines are on the derrick floor, there is danger of the men slipping while walking near the engines if water, oil and mud have accumulated there. If a crewman should slip and start to fall, he instinctively grabs for the first thing at hand, which is frequently the fan shroud, often resulting in injuries to the fingers.

This contractor cut a two-foot length of one-half-inch pipe and flattened the ends. Three-eighths-inch holes were drilled in the flattened portion. The pipe is positioned diagonally with the top portion extending toward the back near the vacuum gages as shown in the accompanying picture.

This safety brace on several occasions has saved a man's hand.



Junk Box Accommodates Sub Uprights

One Gulf Coast drilling contractor has designed a junk box from used pipe and tank steel. The junk box is skid-mounted on four-inch pipe skids which are reinforced by two-inch pipe. The walls of the junk box are made from two-foot lengths of two-inch pipe welded vertically with a two-inch railing on top. Tank steel is welded on the inside of the two-inch pipe framework, providing a container that can be used to haul such objects as bolts, studs and small rig equipment.

The horizontal end pieces have six two-inch pipes, one foot long, welded vertically to accommodate the subs and nipples commonly used around the rig during drilling operations.

Casing Protectors Used as Boat Bumpers

One of the common transportation problems for offshore operations is that of transportation of the crew. Crew boats are rapidly coming into the drilling picture and the suggestion presented here shows the ingenuity of one oil company boatman in preventing his boat from being damaged when tying it up to a drilling barge dock or structure.

Used casing protectors can be used as bumpers by drilling a one-half-inch hole at the mid-point of this length. A steel eyelet loop is welded to the boat. This eyelet runs through the

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anchor eyebolt. The threaded eyebolt is placed through the hole of the casing protector where the eyebolt has a nut and washer on the outside of the protector and another washer and nut on the inside of the protector so that when the inside nut is made up the protector is securely held.

The placement of these protectors at five-foot intervals around the sides of the boat will result in considerable savings since the sides will not be damaged when tying up.

Swing Plate Provides Temporary Pipe Stand

A simple hinged steel plate mounted on the backup post beside the pipe walkway makes a convenient place to lay the next joint of drill pipe on rigs with low substructures. The plate will swing out of the way when not in use. To make this device, tack weld a small collar over the drill pipe at the desired height that the pipe should be. Design the wider collar with horizontal steel plate welded to the side with

a notch in the top to hold the drill pipe as shown. Slip the entire assembly over the backup post and let it rest down on the tack welded collar. A little grease and the unit is ready for action.

When not in use, the plate is swung 180 degrees away from the walkway out of the way. When the driller calls for the next joint to be pulled into position and measured, the floorman simply swings the joint around with his foot and rests the drill pipe on it. This is an ideal device for small rigs.

Scrap Iron Sampler Catches Well Cuttings

A cutting sampler made from scrap tank iron has been made by one contractor and fastened to the mudline as shown. Resting on the edge of the shale shaker, the device is partly supported by the inlet line which connects into the bottom of the return mudline leading from the wellhead.

The line serves to remove samples of the heaviest part of the well cuttings and deposits them in a flume. A weir type outlet is built at the end of the flume to slow the rate of flow down sufficiently to allow settling of the heavier parts. A side flume is made parallel to the large one to facilitate washing of the cuttings.

The inlet line has an ell on the end turned up to allow the flow to be di-

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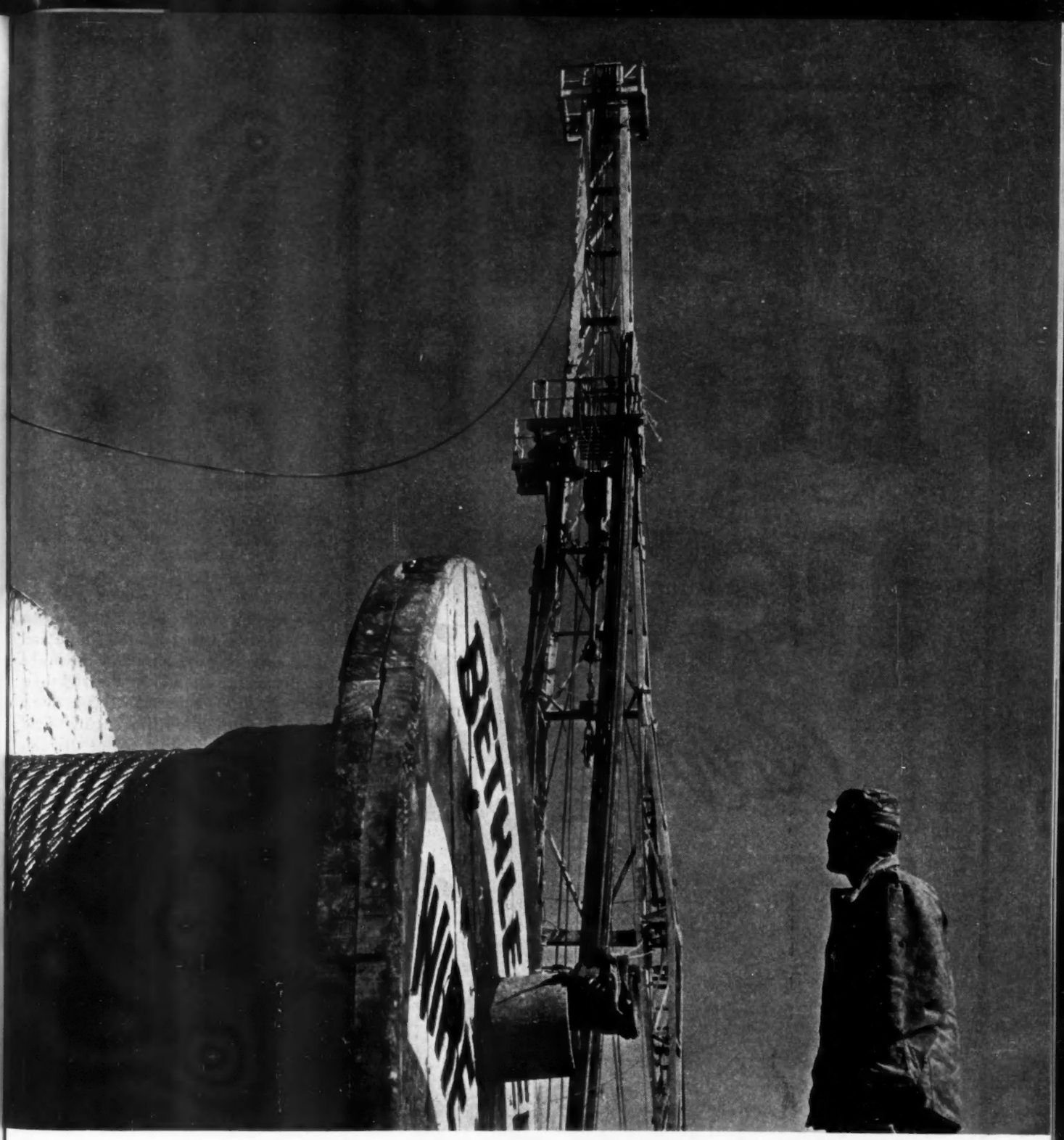

Wire Rope at Work—Hard at it near Alice, Texas, the J. B. Vassey Drilling Company was working at 5600 ft when the photographer took this picture. It was a job on which excellent progress could be made with a 96-ft mast and other lightweight, streamlined equipment.

The rotary line was 1-in. 6 x 21 Seale—Form-Set (preformed) Bethlehem Purple Strand with independent wire rope core. To allow reserve for cutoffs, plenty of extra rope was kept on hand, and some of this you see on the reel in the foreground. Here, at the moderate depths involved, the 1-in. rope proved an excellent choice, easily handling the stand of drill pipe and other loads assigned to it.

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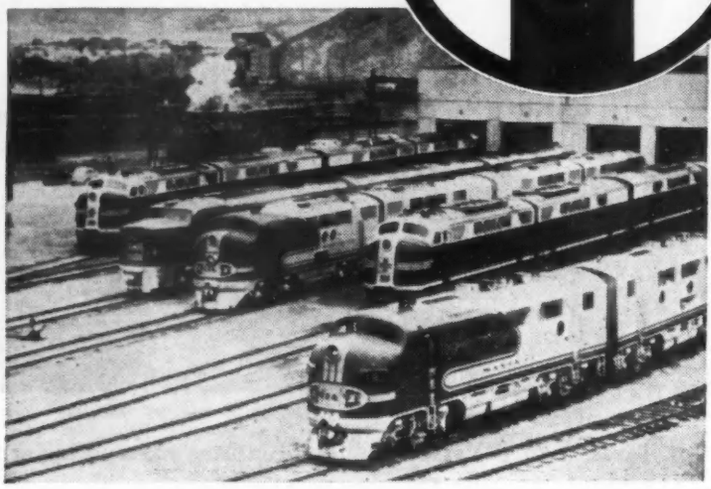

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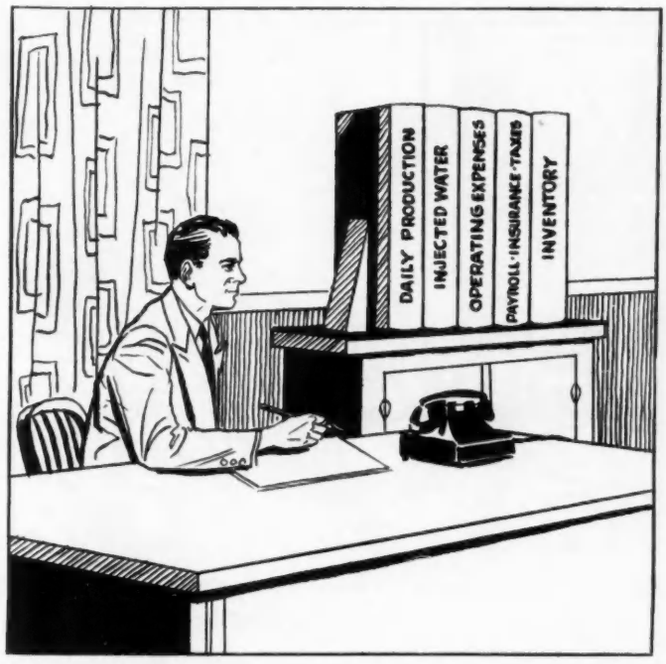
rected upward so that the material will fall out easily. When it is necessary to remove a sample, the floorman takes a shovel that fits the flume and after directing the mud flow down the smaller route shown on the right, he turns fresh water into the large flume and mixes it with the cuttings and washes away the mud. After the cuttings have been thoroughly washed, he puts them in a bucket and later into sample sacks where they are hung up between the engines to dry.

Good Trucking Service Aids Rapid Rig-Up

It is important for the drilling contractor to investigate the trucking contractor as to the type of trucks he has and the caliber of men driving his trucks. Insist that the trucking contractor's truck pusher be on location at all times while rigging up. This is another way of getting a rig rigged-up in record time.

The drawing or diagram for each drilling rig should be given to the truck pusher. There should be a dimension rig-up diagram for each rig, indicating spacing between essential pieces of equipment and respective positions on location. In this way the drilling superintendent or toolpusher supervising rig-up operations and the trucking foreman can spot the equipment readily so that the crewmen can promptly tie it in with other equipment. All equipment should have quick connections. This makes rapid rig-up possible.

How to Reduce Operating Costs In Secondary Recovery . . . . . .



1. Keep accurate books, know exactly where you stand and when you're through.

Turn the page

These cost-cutting practices in Pennsylvania area can apply to secondary recovery operations in oil fields anywhere. Here are some practical ideas.

By K. C. COCHRAN, Vice President,
The Bradley Producing Corporation, Wellsville, N. Y.

CURRENT ECONOMIC conditions have forced all of us to be more conscious than usual of our operating costs.

Generally speaking, our industry in the past has enjoyed an economy that has lulled us into operating habits we can no longer afford. Now we find ourselves facing an operating statement covered with red ink.

Our ability to keep costs under control is going to determine to a large extent the life of our industry. How can we control costs? Here is one approach:

Most of our costs fall into a few clearly defined categories, such as, material and equipment costs, labor costs, service costs, power costs and taxes.

Materials. Offhand it doesn't appear that we can do much about material costs. They are fairly competitive and prices are fixed, but there are some things we can do. We can buy in economic units that will allow discounts. We can watch our stocks to prevent overstocking or the stocking of unnecessary items. We can reduce our inventory by eliminating those items that are readily obtainable from supply stores.

We can check the use we make of various items to determine if a less expensive substitute can be found. We can check requisitions to find if all the items listed are necessary.

The use of good second hand material should not be frowned upon. It is fully realized that the indiscriminate use of second-hand material will result in excessive maintenance, but the proper grading and conditioning of many items used in the industry will result in making available for re-use at low cost many thousands of dollars worth of satisfactory material. Putting pipe in junk classification prematurely is controllable waste that we can avoid. The life of the average flood is around 20 years, yet there are many gas transmission lines that have been in use for over 60 years. Pipe particularly does not corrode uniformly.

We can reduce the corrosion of pipe by using any of a number of commercial coatings available on the market.

Several years ago our records disclosed that most of our tubing leaks in input wells occurred near the casing joint. We adopted a policy of coating the top 25 joints of tubing in all such wells. We have never had a leak in wells so coated. True, we haven't beein doing it long enough to give a valid test, but recently we did have occasion to remove some of this pipe and it showed no evidence of the usual corrosion found in such pipe.

We have found it to be economical to coat all pressure lines larger than two-inch.

Maintenance. The periodic checking of the maintenance of old equipment is recommended. It is often less expensive to consider the replacement of an old engine than to continue to

2. Careful planning of every job is important to prevent lost time and waste of manpower and equipment.

3. Check power consumption to insure most efficient operations. Well conditions frequently change necessitating adjustments.

patch up cylinders, heads, pistons and bearings of old discontinued power units.

Don't forget the small items we use every day. The stuffing box packing, the liner and polish rod wear that can be eliminated by properly adjusting the setting of our jacks.

Labor. One of the largest items of cost, and one over which we exercise considerable control, is labor. This doesn't mean we should cut wages. Far from it. Like most everything we buy, the quality costs more but generally is less expensive. Labor is no exception to this rule. The problem, therefore, is to better utilize the product we have purchased.

Do we plan the man's work in a way to fully utilize his talents or time? Do we coordinate the operation to get the men, material and equipment necessary to do a particular job, at the right place at the right time, so that no one is sitting around waiting?

Employe relations. We should keep our men informed as to what is going on and why. They should be trained for their work. How many pumpers actually understand the mechanics of pumping? It isn't their fault if we haven't explained to them what they are expected to do and how to do it.

We can do a much better job of selling our men on their stake in our industry than we are now doing. During the last years of a water-flood operation the pumper and roustabout take a lot more out of a property in wages than the operator does as profit.

We can develop cost consciousness in our men so they will not waste material. How many of our men know the cost of a 2-inch malleable steel street ell, or a 1-inch clamp gate, or even a pull rod clamp they use to throw at squirrels? We posted prices of items commonly used in the field, on each of our leases. It had a tremendous effect in reducing waste.

No other industry suffers the misconception that is had of the oil industry. The average person, even some of our lease workers, believes that a producing well automatically creates tremendous wealth. We know it doesn't but we don't do much to discourage the impression. How often have you heard your men use the expression "the hell with it, the company has lots of money?" If we don't correct this impression we can't expect a healthy attitude and a good day's work from a man.

Safety Programs. An active safety program pays big dividends regardless of the size of the company. Seven years ago at the time our company instigated a safety program our frequency rate was 56 and our severity rate was 1.18. We had 56 lost-time accidents.

Due almost solely to the dedicated efforts of one man, our safety director, Charles Fuller, our accident rates have steadily fallen until they are now, frequency 14, lost-time 12, severity .153.

This program has not only reduced a lot of suffering and pain, but has also been a direct saving in dollars we pay in compensation insurance premiums.

These savings alone amount to more than $30 per employe per year.

The success of this program was an eye opener as to the results we can expect by placing proper emphasis on our problems.

Training. Training of supervisory personnel is extremely important in reducing operating costs. Our foremen are the people we depend on to supervise our employes and transmit policies and information. How well qualified are they to do this work?

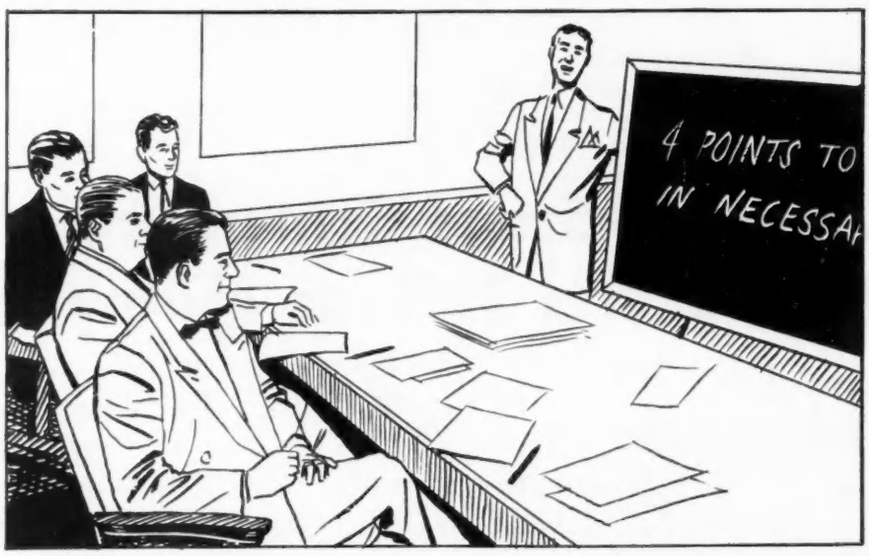
To analyze the subject of foremanship is beyond the scope of this talk, but a well planned foreman's training program will help to reduce operating costs.

Teach your supervisors the basic

4. Check inventories to prevent overstocking of some items. Buy in economical units, taking advantage of discounts.

principles of foremanship and you will get better results from them, and more work from their men.

Standardization. Adopt standard hookups for as many of your installations as possible. Standardize on a bottom hole hookup, a top hole hookup, a method of setting jacks. You can even standardize pressure plant installations. Standardization makes it easy to order materials, to estimate costs, to train men, to control stock and do many other operations easier. They save time and reduce costs. Don't wait until you have found the best way before standardizing. Just find a good way and start using it.



5. Training supervisory personnel is essential in reducing operating costs. They translate policies into practice.

Job Planning. Periodically analyze each job. Review its requirements. Find out how much time is required to do it. Think about ways of doing it better or quicker. Determine if it is worth doing at all. A study of this kind will assure that you efficiently employ each man. Our working conditions are not static, they are constantly changing.

Take a pumper's work for example. At the beginning of a flood he has meters to read, his wells pump a long time and he is responsible for a large oil production. It is very important that he knows the conditions of his wells, and that he reports them for servicing quickly.

Ten years later his job has changed considerably. His intake wells have settled down and it's no longer necessary to have a meter on each individual well, a few master meters for the control of leaks will suffice. Certainly his production is down. His producers will pump off quicker. If a well needs servicing and it is only making a quarter of a barrel a day, it's not too important that it be pulled immediately. Consequently a study may reveal that part of his time can be more efficiently used elsewhere.

Another high labor cost maintenance operation is that of pulling. Analyze your pulling operation. Rod jobs, tubing jobs, balls and seats, barrel and plunger wear. How many of each type do you have, and what causes the breakdown? Chances are some of the jobs can be eliminated. By adopting a simple policy of hooking wells off the power when they are pumped off, and checking rod line support we reduced our pulling one third.

Do you have a policy of inspecting working barrels wherever it is necessary to pull wells for a tubing leak?

Power Costs. Power consumption and power costs seem to keep going up and up. They require constant watching to avoid waste. To help control power expense I would suggest that a periodic recalculation of all power loads should be made to insure the efficient use of the power you buy. The high cost of maintaining obsolete equipment has been mentioned. This is often exceeded by the

Continued on Page 180

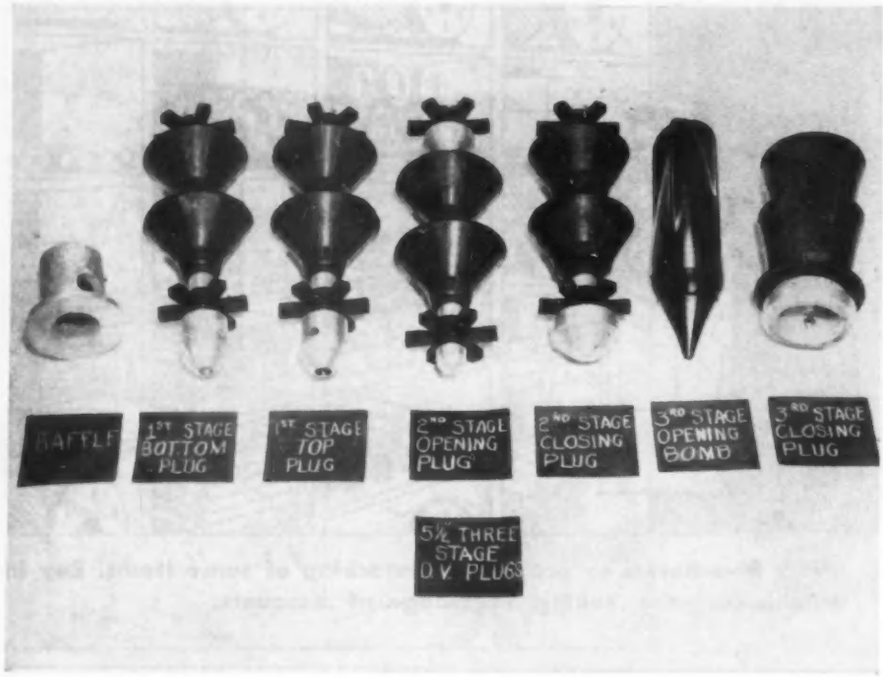


Fig. 1—Various plugs used in the three-stage cementing operation.

Multiple-Stage Cementing Uses 2 and 3-Stage Methods

Latest techniques permit:

- Full depth cementing
- Cementing off formations at any point
- Reducing pump pressures
- Preventing loss to thief zones

By PHIL MONTGOMERY, Halliburton Oil Well Cementing Company
Duncan, Okla.

MULTIPLE-STAGE CEMENTING is the placement of cement at more than one place about a string of casing in a well bore during the course of the initial cementing job. It is growing in importance throughout the oil country, and within the past several years, a larger number of wells have been completed in this manner than ever before. This increase has been due to the improvements in equipment and technique as well as the realization of advantages to be gained from the divided placement of cement about a string of casing.[1]

Multiple-stage cementing is accomplished by placing part of the cement out through the shoe and one or more other parts of the total amount required out through side openings in the casing provided in stage cementing devices.

While more than two stages can be run, the largest part of jobs performed are done in two stages. During the last two years, several jobs in different oil fields in the U. S. have been performed using the three-stage method and they have been successful.

Two-stage method. Multiple-stage cementing using the two-stage method makes it possible to do a cementing job at the bottom through the casing shoe with the second cementing job being placed through the two-stage tool at any pre-determined point in the casing. These cementing jobs can be done as a continuous operation, or it is possible to do the bottom job first, open the tool and circulate before cementing through the two-stage tool. A few of the advantages of this type of arrangement are:

- Full depth cementing.
- Cementing off formations at any point.
- Reducing pump pressure.
- Preventing loss of cement slurry to thieving formations.

Many of these tools have been run both in this country and abroad in many different fields to overcome special problems at all depths. After the cementing job has been completed on the two-stage tool, a special plug closes the tool by operating a built-in sleeve in the tool. Different types of plugs are built to be used in the two stage tools to suit various types of operations. Where the bomb-type plug is used to open the two-stage tool, it is possible by using a special adaptor on this bomb-type plug to run it in the casing on a line. After the multiple-stage tool has been opened and circulation established, this plug is pulled back out of the casing. By this arrangement, a temperature survey can be run on the cement job below the multiple stage tool.

Three-stage method. Figures 2 through 7 show the operating procedures of the three-stage cementer during a casing cementing job. Figure 1 shows the various plugs used in the three-stage cementing operation. By using this method, it is possible to do a job through the casing shoe and two other cementing jobs at predetermined points in the casing. The first two jobs are run as a continuous operation. Then a bomb-type plug is used to open the third stage tool to do the third cementing job.

It is also possible to do the first

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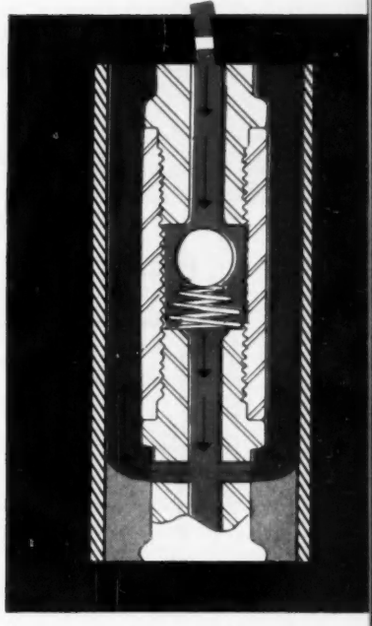

Schematic drawing illustrates flow pattern of injected fluid through hollow rod and check valve, out pony rod perforations and into the production annulus.

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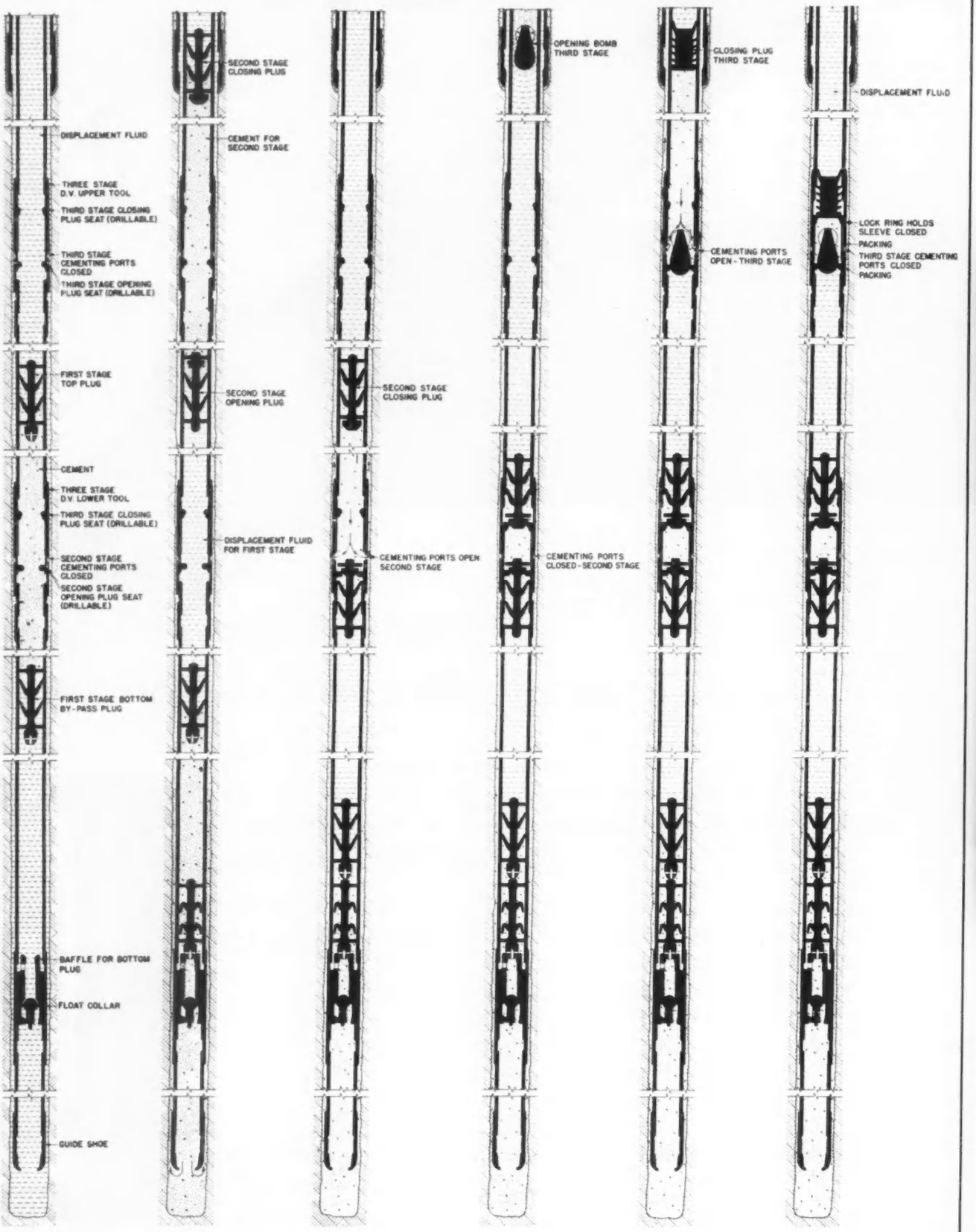
DISPLACEMENT FLUID
THREE STAGE D.V. UPPER TOOL
THIRD STAGE CLOSING PLUG SEAT (DRILLABLE)
THIRD STAGE CEMENTING PORTS CLOSED
THIRD STAGE OPENING PLUG SEAT (DRILLABLE)
FIRST STAGE TOP PLUG
CEMENT
THREE STAGE D.V. LOWER TOOL
THIRD STAGE CLOSING PLUG SEAT (DRILLABLE)
SECOND STAGE CEMENTING PORTS CLOSED
SECOND STAGE OPENING PLUG SEAT (DRILLABLE)
FIRST STAGE BOTTOM BY-PASS PLUG
BAFFLE FOR BOTTOM PLUG
FLOAT COLLAR
GUIDE SHOE
PUMPING CEMENT 1st. STAGE
FIGURE 2
SECOND STAGE CLOSING PLUG
CEMENT FOR SECOND STAGE
SECOND STAGE OPENING PLUG
DISPLACEMENT FLUID FOR FIRST STAGE
DISPLACING CEMENT - 1st STAGE & PUMPING CEMENT - 2nd STAGE
FIGURE 3
SECOND STAGE CLOSING PLUG
CEMENTING PORTS OPEN SECOND STAGE
DISPLACING CEMENT 2nd. STAGE
FIGURE 4
OPENING BOMB THIRD STAGE
CEMENTING PORTS CLOSED - SECOND STAGE
DROPPING BOMB TYPE PLUG - OPENING 3rd. STAGE CEMENTING PORTS
FIGURE 5
CLOSING PLUG THIRD STAGE
CEMENTING PORTS OPEN - THIRD STAGE
DISPLACING CEMENT 3rd. STAGE
FIGURE 6
DISPLACEMENT FLUID
LOCK RING HOLDS SLEEVE CLOSED
PACKING
THIRD STAGE CEMENTING PORTS CLOSED
PACKING
3rd. STAGE CEMENTING PORTS CLOSED
FIGURE 7

SCHEMATIC DIAGRAMS illustrate the various steps in cementing a casing string in three stages. Note that with this system, cement may be displaced out the casing shoe, and out the casing at two separate horizons above bottom.

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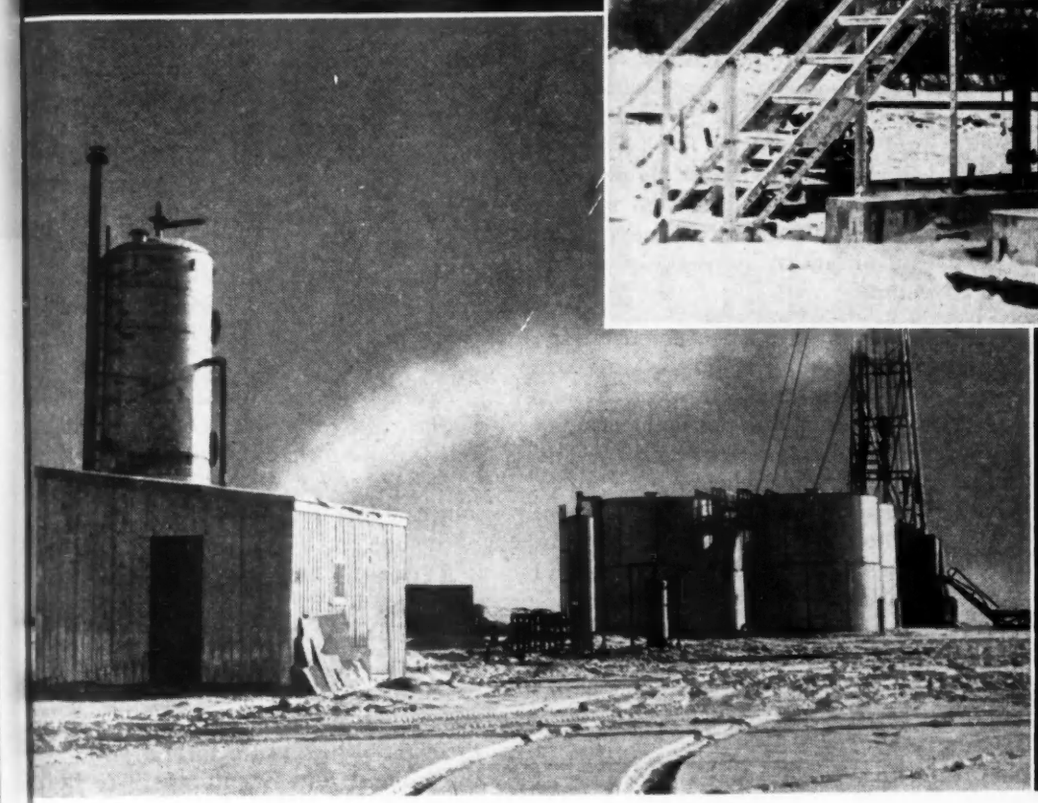
National

TANK ENGINEERS SOLVE CRUDE HEATING PROBLEMS IN LEDUC FIELD



SOUTH LEDUC—4' x 27½' "YCP" 15# National Treater

LEDUC—4 Hi-500 Bbl. National Bolted Steel Tanks

1 6' x 20' "YIWP" 15# National Treater

1 2C, 2½' x 13' 125# National Separator

1 NC, 2' x 6' 125# National Separator

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They can be shut down for several days without draining without fear of freeze-up. If a longer shut-down is necessary, water can be drained quickly. Refilling to go back into operation can be done easily and at a minimum cost.

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job through the casing shoe, open the first tool, circulate, allowing the cement to set in the first job, and then do the job through the first tool. It is possible to go ahead and open the second tool and allow the cement to set that has been placed through the first tool before doing the cementing job on the last multiple stage cementer for the third stage.

This arrangement requires special opening and closing plugs and tool sleeves in order to do three-stage cementing. The three-stage cementing method has been run successfully in the field and has been used in working with special field problems which have arisen.

The type of multiple-stage cementer used in both two and three-stage cementing closes off and seals the side cementing ports by means of a steel sleeve at the conclusion of the job. Thus, no opening remains which could in the future allow either entry into or exit of fluid through the casing. Construction of these tools is such that when closed, the ports will withstand pressure in excess of bursting or collapsing of the casing being used.

The use of stage cementing, both two and three-stage, reduces pump pressure during the cementing operation. This pump pressure can also be further reduced by using special blended low-weight cementing slurry materials.

With the use of modern bulk cement blending equipment, cement can be compounded with closely controlled materials making it possible to prepare a cement that fits practically any given well condition.[2] By the use of the two and three-stage cementing method, it is possible to place either two or three different types of material at any predetermined point behind the casing. This allows the operator to use the best type of cementing materials to overcome different conditions at different points behind the casing.

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—The End

How to Reduce Operating Costs in Secondary Recovery

Continued from Page 175

high cost of running it. The gas engine was developed in this field. It was developed when there was plenty of gas at little or no cost. "Engine efficiency" was not in the vocabulary of the designers of some of our early engines. We are still operating a lot of this equipment. A calculation of the payout of new more efficient equipment in fuel savings alone is convincing evidence that many of our old obsolete power units should be replaced.

We recently took a clamp-on type ammeter and checked the amperage used on some of our electric jacks. Then we loosened the stuffing box until it just held the fluid. The result was an average drop of 25 percent in the amperage required. So we saved power, packing, and revealed another case of an inadequately trained pumper.

Taxes. I have no concrete ideas of how we can reduce taxes. Most of our local taxes are well spent. I would suggest that we can influence taxes more by being good citizens, by voting, and by attending hearings on budgets. Our superintendent of schools recently pointed out that a hearing on a million-dollar budget was attended by five people. We can't complain when we show this lack of interest.

Keep up with new developments. Certainly our industry has made progress in the past quarter of a century, yet many of us are too slow to accept new ideas and proven better ways of operating, and we still stick to our antiquated ideas.

Records. Keeping adequate records is necessary, adequate but not superfluous. Keeping unnecessary records is one of our more prevalent wastes. We must know where we stand. Records are the means of accomplishing this. Knowing where we stand means knowing when we are through.

On any production decline curve there is a point where production realization no longer covers operating expense. The determination of this elusive and ever moving point requires the judgment that can only be acquired by a constant study of both economic and operating conditions.

Many properties are operated at a loss for an extensive period before we realize that we can't pull them back into the blue.

Actually the profits to be realized the last few years of a flood are small and without a thorough knowledge of where we stand, we can operate too long and lose the hard wrought profits of the last years.

Reducing operating costs is no simple problem. The savings made in any particular operation are going to be small, but added together over a period of years they amount to large sums. Any producer not recognizing these problems is sure to leave oil in the ground that might otherwise be recovered.

Know When You're Through. In conclusion, I believe that there is a great deal we can do to reduce operating expenses.

- We can watch our use of materials.
- We can reduce labor costs with a continuous program of organizing, planning, training.
- Study each job, develop a safety program.
- Adopt standard hookups.
- Analyze power costs.
- Keep adequate records and know when you are through.

ACKNOWLEDGMENT

This paper based on a talk given by the author before the fall meeting of the Engineer's Society of Western Pennsylvania, September 16, 1954, at Bradford, Penn.

—The End

About the Author

K. R. COCHRAN is vice president of The Bradley Producing Corporation, whose primary interest is in water-flood production. Born in Vincennes, Ind., where his father was an early oil producer, Cochran moved to Tulsa in 1911 and to Oklahoma City in 1921. He received his degree in mechanical engineering from Oklahoma A & M in 1938, and later worked for Empire Gas and Fuel Company, Ltd., of Wellsville, N. Y. He served in the U. S. Army Corp of Engineers from 1941 through 1945, attaining the rank of captain. He joined The Bradley Producing Corporation when he left the Army.

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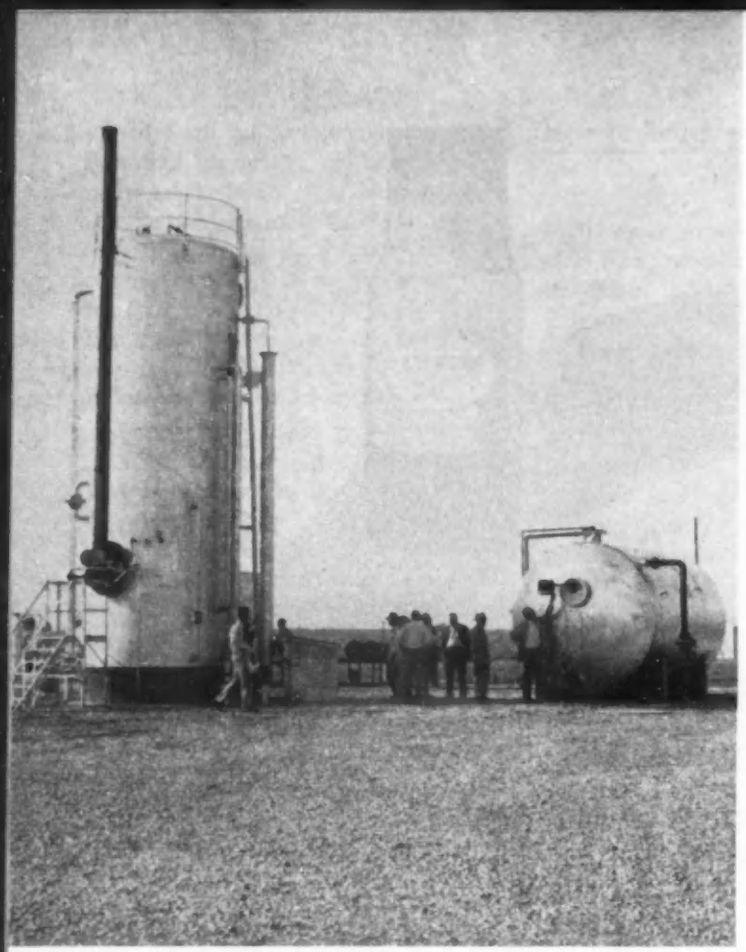
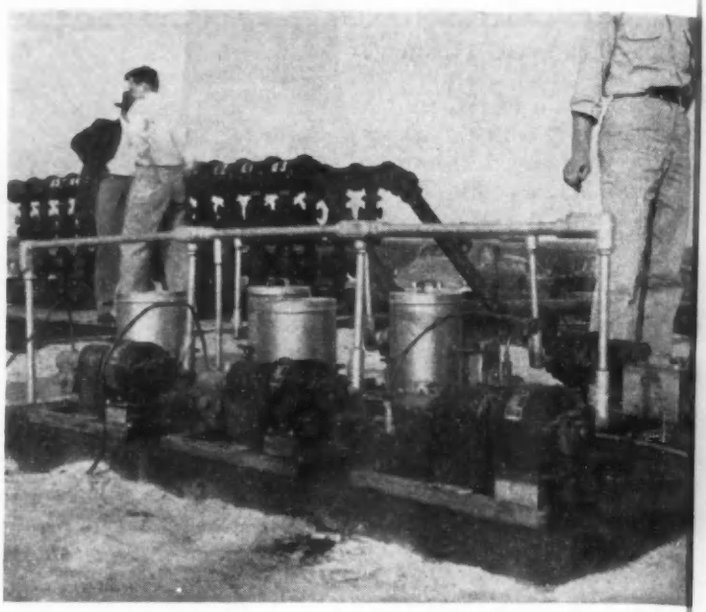


EMULSION TREATER and water knockout on Mid-Burbank Unit.



CHEMICAL FEEDERS and oil-water manifold, South Burbank Unit.

Water-Flooding Revives Famous Burbank Field

Oklahoma's largest secondary recovery project to yield 180 million barrels of oil.

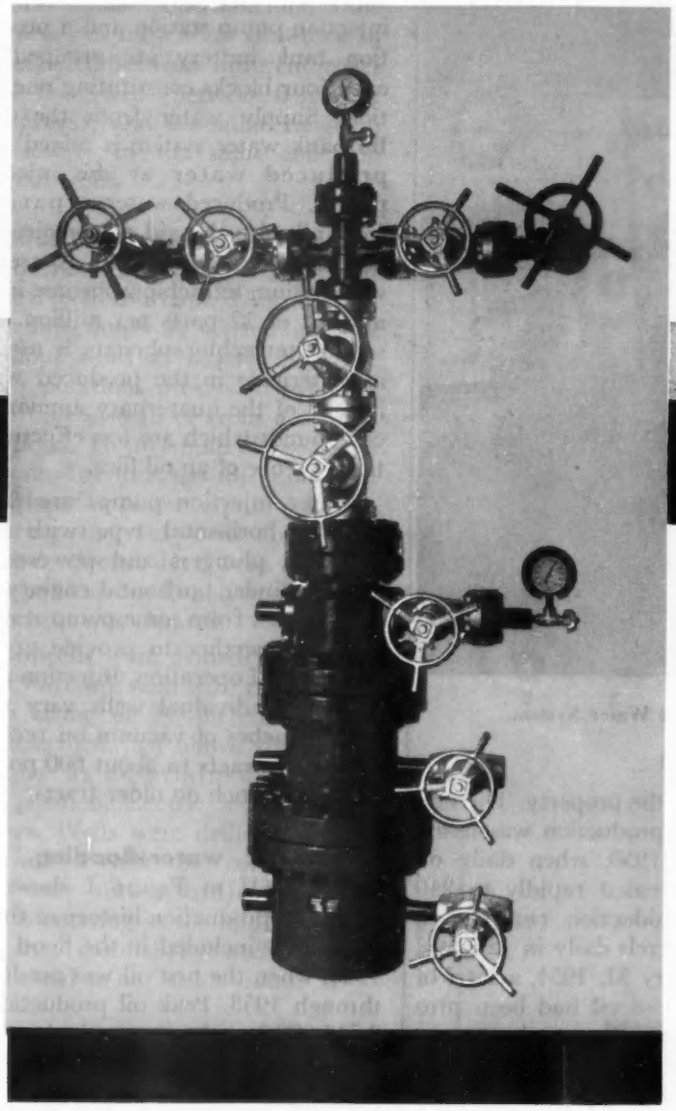
By C. H. RIGGS, Petroleum Engineer,
U. S. Bureau of Mines, Bartlesville, Okla.

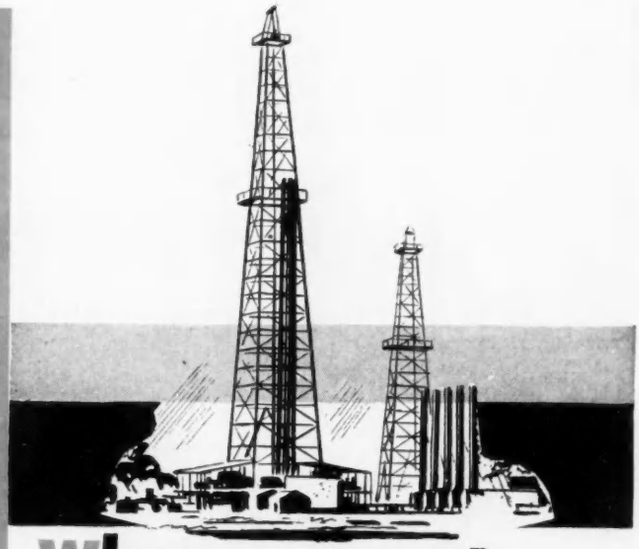
DESPITE THE magnitude of the project and the many operational problems involved, production of oil from the famous Burbank field, Oklahoma's largest water-flood project, is steadily increasing. Embracing some 26,000 acres which eventually will be flooded, the operation is expected to recover 180 million barrels of oil. The field is located in the western part of Osage County. When discovered in 1920, it touched off one of the most spectacular booms in the history of oil in the Mid-Continent area. Since water-flooding operations started some four years ago more than 4 million barrels of oil have been produced from 3825 developed acres. As additional acreage is brought into the project, oil production is expected to increase considerably and engineers hope to complete this phase of recovery in 20 years.

The Burbank floods include the North and South Burbank Units operated by Phillips Petroleum Company, and the Mid-Burbank Unit operated by Kewanee Oil Company.

The formation being flooded is the Burbank sandstone in the Cherokee shales of Pennsylvanian age. Because of the lenticular character, little water has encroached upon the oil-producing sand except in those areas where it immediately overlies the Mississipian limestones. As an isolated sand body fairly homogenous in character and without benefit of structure or natural water drive, the Burbank sand was assumed to be particularly suited to oil production by water flooding methods. It is encountered at depths varying from 2700 to 2900 feet.

Negotiate new contracts. Mineral rights in Osage County, Okla., are held jointly by all members of the Osage Indian Tribe and since the original leases provided for payment of royalty of one-fourth to a minimum of one-sixth of the oil produced in accordance with a sliding scale based on the rate of production, new contracts more advantageous to the operators had to be negotiated before water-flood operations could begin. Recognizing that water-flooding operations entailed added operational expense, the Osage Tribe voted a





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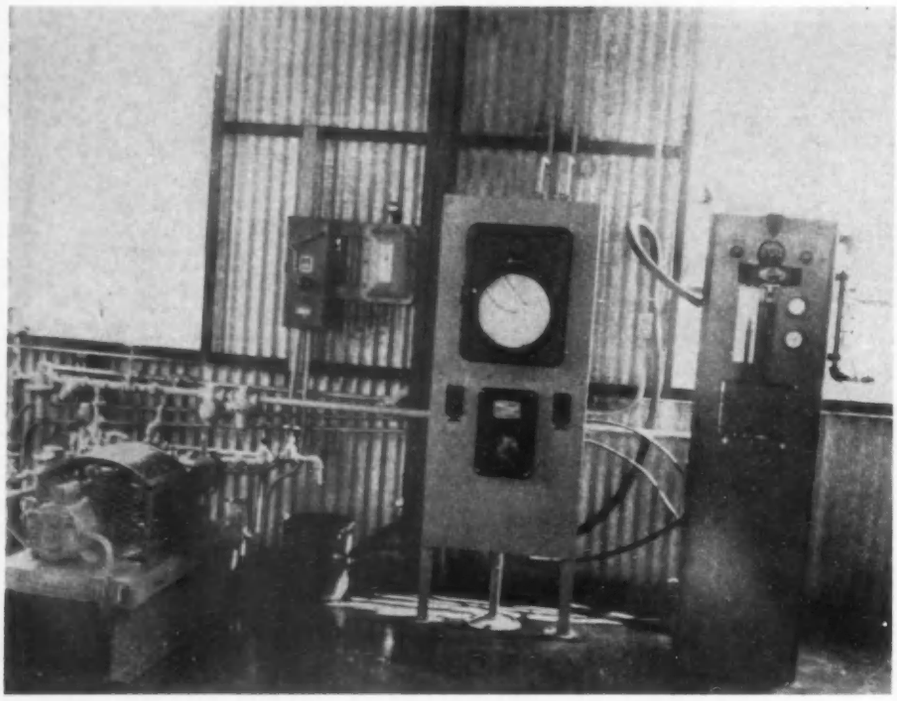

CHEMICAL FEEDER and chlorinator, Ark-Burbank Water System.

reduction of royalty to one-eighth on all oil production greater than 150,000 barrels per month and in excess of 20 million barrels. A new lease was granted in 1949 to the North Burbank Unit for water-flood development on 139 quarter-section blocks comprising most of the Burbank oil field in Osage County. Phillips Petroleum Company was designated as the operator of the communitized unit. Later the lease was enlarged to include a total of 146 blocks. Meanwhile, other leases with similar terms were granted for unitized water-flood development on the Mid-Burbank Unit, the South Burbank Unit and Flood A in the South Burbank and Stanley Stringer areas.

4 Million Barrels at North Burbank Unit

Water-flooding in the North Burbank Unit began with a 160-acre pilot flood on block 127. Late in 1949 and early in 1950, nine water-input wells were drilled on 10-acre five-spot patterns. Three gas injection wells were reconverted to oil producing wells.

Water injection into the nine wells was started in February, 1950, at the rate of 4000 barrels daily. The rate was steadily increased to 9400 barrels daily in 1951 but later in the year cut back to about 4000 barrels daily.

When water injection was started, about 40 barrels of oil daily was being produced from the property. The first increase in oil production was noted in September, 1950, when daily oil production increased rapidly to 240 barrels. Oil production reached a peak of 877 barrels daily in January, 1951. By January 31, 1954, a total of 602,000 barrels of oil had been produced from this property by water-flooding, equivalent to about 3800 barrels per acre.

Extend flood. Early in 1951 the flood was extended to include eight surrounding tracts by converting alternate 10-acre-spaced oil wells to water-input wells, forming 20-acre five-spot patterns.

Tract No. 128, east of the pilot flood, was the first tract in the 1951 extension to show an increase in the rate of oil production. During the succeeding few months other tracts began to show increases as a result of water injection. Daily water production from the blocks increased rapidly until 1953 but decreased following the curtailment of injection rates late in 1953.

The development of the project continued to 1954 at the rate of about 1000 acres per year. Alternate wells were converted to water input wells, and a few new wells were drilled where necessary to complete the pattern.

Injection equipment. Usually one injection pump station and a production tank battery are grouped for each four blocks constituting one section. Supply water from the Ark-Burbank water system is mixed with produced water at the injection pumps. Produced water separated from oil with the aid of chemicals in horizontal heater-treaters is treated with sodium tetrachloraphenate in the amount of 12 parts per million. The sodium tetrachloraphenate is used as a bactericide in the produced water instead of the quaternary ammonium compounds which are less effective in the presence of an oil film.

Water injection pumps are three-cylinder horizontal type with solid porcelain plungers and powered by single-cylinder horizontal engines. Injection lines from some pump stations are tied together to provide greater flexibility of operation. Injection pressures on individual wells vary from several inches of vacuum on recently developed tracts to about 600 pounds per square inch on older tracts.

Results of water-flooding. The upper half of Figure 1 shows the yearly oil-production history of the 35 tracts now included in the flood from 1920, when the first oil was produced, through 1953. Peak oil production of 2,513,000 barrels was reached in 1922 and, with the exception of slight increases during the 1930's, it declined until the first stimulation by water-flooding in 1950. When unitized in 1949, the properties were producing about 204,000 barrels of oil per year. It is estimated that the total oil production from these tracts by primary production methods, and by gas injection was approximately 25,440,000 barrels and that since water-flooding was initiated, approximately 4 million barrels have been recovered through March, 1954.

The lower half of Figure 1 shows the average daily oil and water production per month from the 35 tracts and the average volume of water injected daily.

Mid-Burbank Developed Without Pilot Flood

The Mid-Burbank Unit, operated by Kewanee Oil Company, includes 635 developed acres on ten quarter-section tracts. The Burbank sand averages about 50 feet in thick-

ness and is about one-half mile wide. Core analyses show wide variations in permeability between different zones in the same well (between 0 and 32 millidarcys), and a similar range in permeability in the same zones in different wells.

No pilot flood. Development of the Mid-Burbank unit differed from that of the North Burbank Unit in that water injection was started into all the input wells at nearly the same time. Operations proceeded over the entire unit instead of from a central pilot flood. Twenty-nine old oil wells and one former gas-injection well were used as water input wells. In preparing the old wells for water injection, electric logs were run, the casing was scraped, and the bottom of the hole was cleaned.

New wells were drilled to the top of the Burbank sand with rotary tools and a string of 5½-inch casing set and cemented just above the actual pay zone as determined by structural position, electric log and core analyses. Wells were drilled into the sand with a cable-tool core drill. A water-entry survey indicated that water is entering in the middle of the sand that gamma-ray and driller's logs showed to be "clean" sand.

Operating practices. River water from the Ark-Burbank water system is delivered to the Mid-Burbank Unit through a ten-inch line at an average pressure of about 100 psi, although the line pressure fluctuates widely as a result of operational changes on the North Burbank Unit. The pressure is reduced to about 50 psi by a regulator and water then passes through two ten-foot sand filters to remove any iron sulfide or pipe scale. The filters are backwashed once every three months.

Produced water passes to two other ten-foot filters, one of which is filled with sand and gravel and the other with crushed anthracite coal. These filters are backwashed once every two or three weeks. Two 1000-barrel tanks serve alternately as source water for backwashing and to receive the backwash material. Sediment from the backwash tank is drained into an open pit.

River water and produced water are not injected into the same wells although the type of water injected into several input wells has been changed, depending upon the pressure required. Most wells take water by gravity, but some pressure is required to deliver water to those wells that are topographically higher. Because more line pressure is available on the fresh than on the produced water line, higher input wells are connected to the fresh water line. Two parallel four-inch trunk lines transmit water from filters to field headers.

Producing wells are pumped with individual jacks, operating with a 54-inch stroke and at 17 strokes per minute. Units are powered by 16- or 25-horsepower electric motors, de-

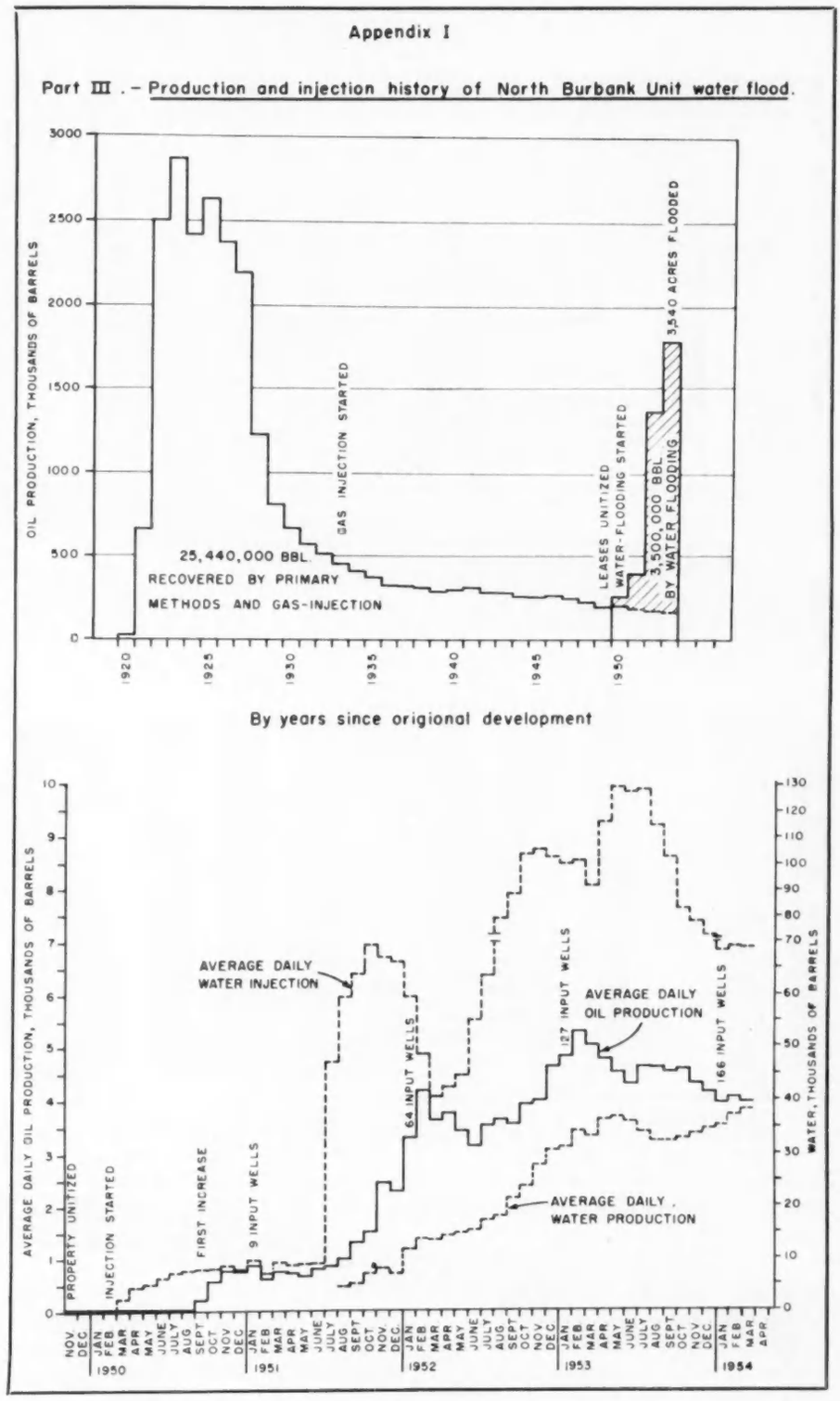
Appendix I
Part III .- Production and injection history of North Burbank Unit water flood.
OIL PRODUCTION, THOUSANDS OF BARRELS
25,440,000 BBL RECOVERED BY PRIMARY METHODS AND GAS-INJECTION
GAS INJECTION STARTED
LEASES UNITIZED WATER-FLOODING STARTED
3,500,000 BBL BY WATER FLOODING
3,540 ACRES FLOODED
By years since origional development
AVERAGE DAILY OIL PRODUCTION, THOUSANDS OF BARRELS
WATER, THOUSANDS OF BARRELS
AVERAGE DAILY WATER INJECTION
AVERAGE DAILY OIL PRODUCTION
AVERAGE DAILY WATER PRODUCTION
PROPERTY UNITIZED
INJECTION STARTED
FIRST INCREASE
9 INPUT WELLS
64 INPUT WELLS
127 INPUT WELLS
166 INPUT WELLS

Fig. 1—Production and water-injection history of North Burbank Unit water-flood, Osage County, Oklahoma.

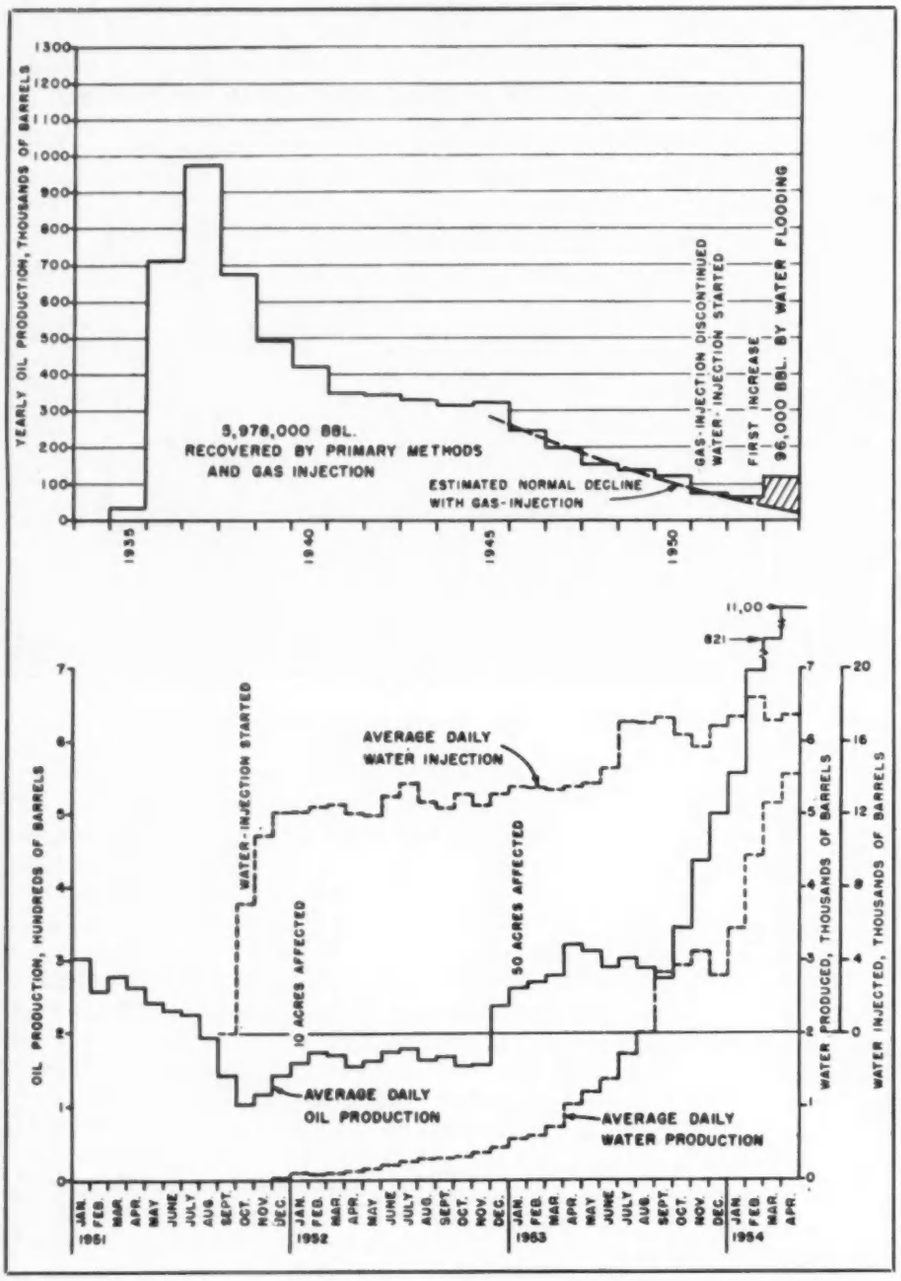

Fig. 2—Production history of Mid-Burbank Unit water-flood, Osage County, Oklahoma.

pending upon the total quantity of lifted fluid.

Produced oil and water flow together through four-inch lines to a 10 x 28-foot heater-treater maintained at about 120° F. Chemicals injected at the heater-treater help separate the oil and water. Produced oil passes to six 1000-barrel welded steel stock tanks.

Aluminum electrical transmission lines have been constructed to provide 480-volt electric current for a possible 40 producing wells. Lightning arrestors and load capacitors are provided at each pumping well.

To aid production and injection operations, a central header assembly consisting of five vertical chambers was installed. This compact header permits easy access to all valves and meters.

Results of water-flooding. The oil and water production history of the Mid-Burbank Unit is shown graphically in the lower half of Figure 2. Daily oil production decreased perceptibly in September, 1951, as a result of the discontinuance of gas injection. The first production increase attributable to water flooding occurred in May, 1952. By April, 1954, approximately 1100 barrels of oil and 5500 barrels of water daily were being produced as a result of the injection of 12,000 barrels of river water and 5500 barrels of salt water. The 17,500 barrels of water injected daily through 37 input wells amounts to about 475 barrels per input well as compared with nearly 1000 barrels per input well for the peak rate of injection on the North Burbank Unit.

The increased oil recovery attributable to water-flooding is approximately 153,000 barrels, or 235 barrels per acre, through March, 1954.

South Burbank Unit Was Started in 1951

The discovery well in the South Burbank field was completed January, 1934, at a depth of 2700 feet. In the subsequent development of the field, eight wells were drilled on each quarter section in a staggered pattern, two or three of which were completed as gas injection wells.

Source and treatment of water. Water from the Ark-Burbank water system enters the South Burbank Unit at a field header where it is distributed without treatment to about half of the input wells. Produced oil and water is separated in three 8 x 22-foot horizontal heater-treaters which are not fired. Emulsion-breaking chemical, diluted with equal parts of kerosene and xyolene, injected at the header, aids the oil and water separation.

Twelve parts per million of sodium tetrachlorophenate is added to produced water in the heater-treater. Produced water from the heater-treater passes to four 12-foot closed-type filters containing graded anthracite coal on a sand bed. Only two of the filters are in regular use while the other two are being backwashed once each day. The filtered produced water goes to a header where it is distributed through three-inch, lightweight, steel pipe to about half of the input wells. Selection of wells to be connected to each of the two water-distribution system is made arbitrarily and periodically each system is used for fresh water while the other is used for brine so that any salts which are deposited by the brine will be redissolved by the fresh water.

Results of water-flooding. The rate of oil production declined sharply late in 1951 with the discontinuance of gas injection and the initiation of water-flooding. (See Figure 3.) The

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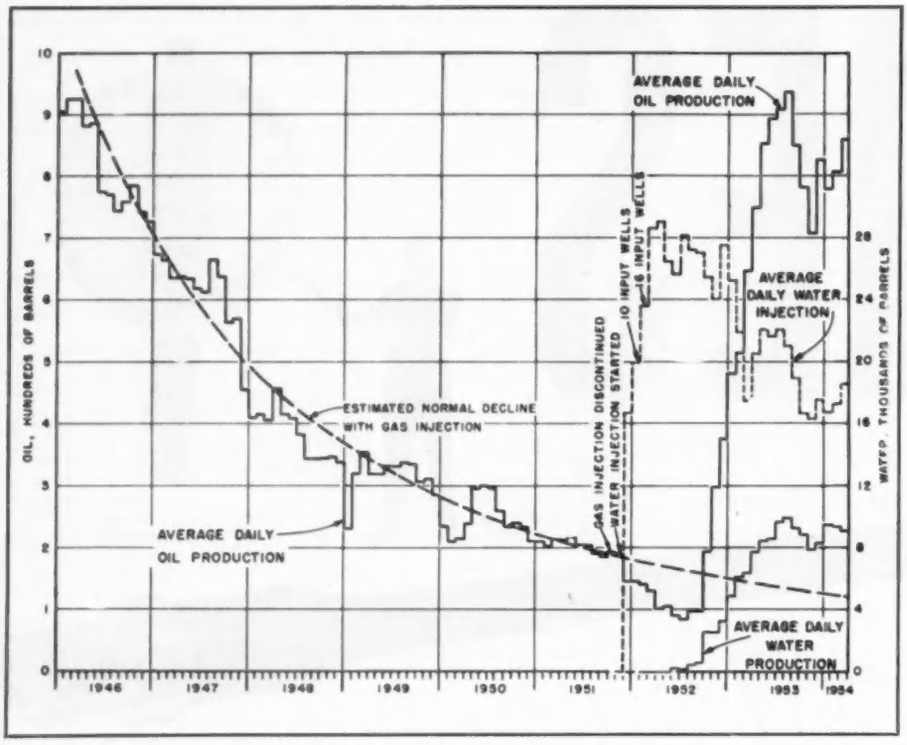


Fig. 3—Production and water injection history of South Burbank Unit water-flood, Osage County, Oklahoma.

first increase in the rate of oil production was noted in July, 1952, and by December of that year three wells had shown increases totaling 162 barrels. A peak rate of 930 barrels daily was reached in August, 1953, and by March, 1954, the rate of oil production had declined to about 700 barrels daily. The rate of water production began to increase in July, 1952, together with the increase in oil production. Between April, 1953, and February, 1954, the rate of water production was more or less constant at 8000 to 9000 barrels daily. The produced water-oil ratio has remained nearly constant since the first increase in produced fluid, indicating channeling between injection and producing wells. On March 15, 1954, the 19 oil wells on the South Burbank Unit flood were producing about 700 barrels of oil and 9000 barrels of water daily. Cumulative oil production through March, 1954, amounted to 328,578 barrels as a result of water injection.

Ark-Burbank Water System Serves All Flood Units

It takes thousands of barrels of water daily to supply the combined Burbank flood units and the Ark-Burbank water system was developed to provide the water for these large scale operations. Seven wells, 56 to 59 feet deep, and 20 inches in diameter, each capable of producing 30,000 barrels of water daily, were drilled into gravel beds underlying the Arkansas River near Kaw City, Okla.

Pumping equipment. The wells are pumped with two-stage turbine pumps powered by 35-hp single-cylinder engines. Speed of several of the pumps is varied by a float in a 44,000-barrel storage tank to provide a constant reserve of 30,000 barrels of water. Provision is made for bypassing the supply tanks for semi-annual inspection and cleaning.

Four two-stage 1900 rpm centrifugal pumps, each capable of delivering 70,000 barrels of water daily at a pressure of 215 psi, pump water to the field. Each pump is driven through speed-increasing gears by a 400-hp V-type, 6-cylinder gas engine operating at 425 rpm. Speed of the engines and pumps is automatically regulated by pressure in the field transmission line. Only one pump and engine now are being used to deliver 60,000 barrels of water daily to the developed floods.

All motor and valve controls are automatic and are equipped with alarms and automatic shutoffs. Flow to the field is metered through a short Venturi tube in the 30-inch line.

Water treatment. As produced from the wells, river water contains almost no solids but includes large quantities of sulfate-reducing bacteria. Unless killed, these bacteria act on the sulfates to release hydrogen sulfide which attacks pipe and equipment and dissolved iron to form finely divided insoluble iron sulfide that plugs the injection wells.

Originally, formaldehyde was used as a bactericide, but subsequent tests showed that it was ineffective. Most of the bacteria are resistant to 50 ppm of chlorine. Now quaternary ammonium compounds and chlorine are used to kill bacteria. The quaternary ammonium compounds are injected at the base of the storage tanks in amounts automatically controlled at six ppm by the volume of water pumped to the field. About 20 to 22 pounds of chlorine are injected daily at the pumps to kill certain bacteria that are resistant to the ammonium compounds. Periodically, samples of water are taken in sterile bottles at the plant and at stations along the line to the field. The quantity and type of water treatment are governed by the results of microscopic examinations of these water samples.

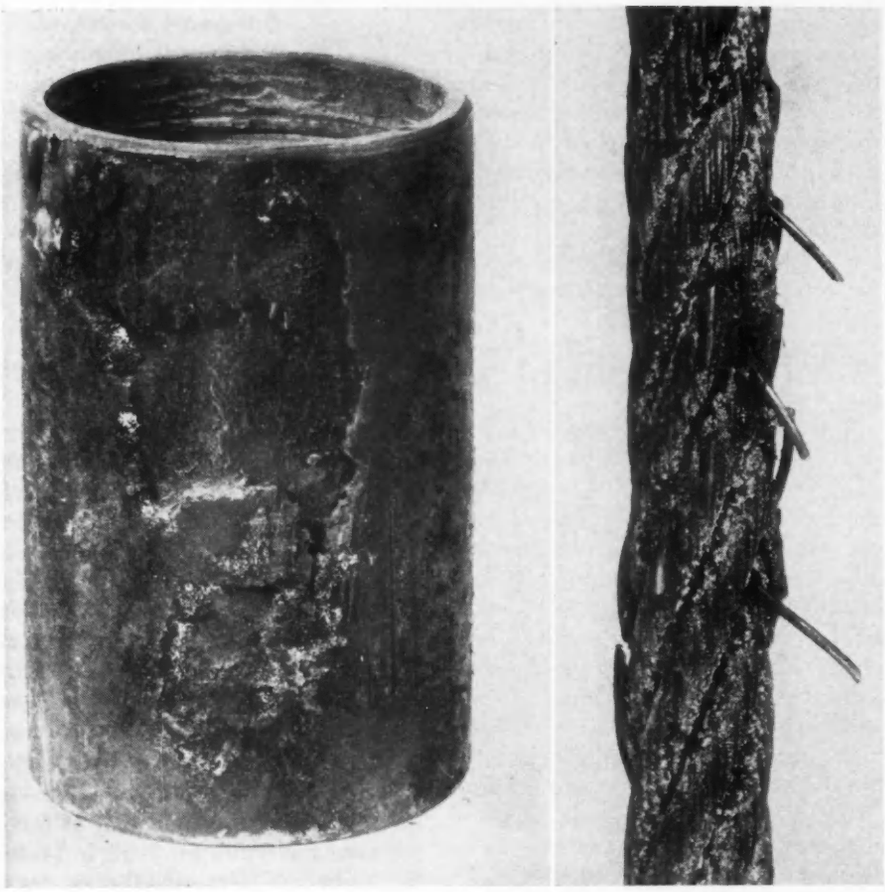
Gas storage system. Phillips Petroleum Company, operator of the North and South Burbank Units, made a study of energy requirements and concluded that gas engines would be most practical and economical to pump oil and water. However, the quantity of gas available from the local gas line for use in the Burbank field varies widely, depending on other seasonal demands.

To provide a year-round supply, gas is stored in the summer and withdrawn in the winter when deliveries from the gas supplier are curtailed. The gas storage system employs a formerly abandoned gas-storage field about eight miles east of Shidler, Okla.

ACKNOWLEDGMENT

This article is based on a report prepared in connection with a tour of the projects described sponsored by water-flood operators in Oklahoma and Kansas. Data were obtained from the Osage Indian Agency at Pawhuska, Okla., Phillips Petroleum Company and Kewanee Oil Company. Monthly reports by the unit operators to the Osage Indian Agency, as well as development projects for the ensuing year, were specially useful. Particularly helpful was "A Report on Water-Flooding in the Burbank Area" prepared June 19, 1953, by the Engineering Department of Kewanee Oil Company. The assistance of Z. Z. Hunter, T. A. Mathews, and other personnel of Phillips Petroleum Company, and of F. D. Baker and other personnel of Kewanee Oil Company is gratefully acknowledged.

—The End



THIS COULD HAVE BEEN AVOIDED. Corroded tubing collar (left) is the result of vapor space corrosion in a sour well near Artesia, N. Mex. Drilling line (right) was attacked by hydrogen sulfide corrosion. This damage could have been prevented by lubricating with an organic inhibitor in oil when line was run.

How Inhibitors Work In Subsurface Corrosion

The right inhibitor applied on a rigid schedule can control corrosion.

By JAMES D. CRAWFORD and THOMAS M. NEWELL,
Cardinal Chemical, Inc., Odessa, Texas

SUCCESSFUL CORROSION control in producing oil wells depends upon two indispensable factors: (1) the inhibitor must be capable of controlling the corrosion, and (2) it must be applied on a rigid schedule and in such a manner to insure its contact with surfaces to be protected.

Acidic substances which are dissolved in the brine of producing reservoirs cause the most troublesome corrosion. These acids are hydrogen sulfide (sour gas), carbon dioxide (the principal destroyer of subsurface equipment), and organic acids (such as the acetic acid which is present in vinegar). Steel immersed in fluids which contain acidic brines and oils will be dissolved at a rate depending upon four primary factors.

- pH of the brine.
- Temperature.
- Crude composition.
- Water-oil ratio.

pH of brine. The pH is a direct measure of the acidity of a solution. The lower the pH, the more potentially corrosive the system. It is dependent, among other factors, upon the concentration of acidic substances in the produced brine. Since both hydrogen sulfide and carbon dioxide are gases, wells which produce these substances will tend to be more corrosive at high pressures. This is true because gases are more soluble in the brine at high pressure. This phenomenon is a partial explanation of why some wells are more corrosive at bottom-hole conditions than they are at the surface.

Some of the other materials which are dissolved in oil field brines act as "buffers." These substances will not be discussed here except to state that they permit quantities of acidic substances to be dissolved in brine without a substantial decrease in the pH.

These materials are mentioned simply to demonstrate another reason why two wells, both of which contain high concentrations of acidic gases, may differ widely in their corrosiveness. The one which is well "buffered" will tend to be less corrosive than the other, all other conditions remaining the same.

Temperature. As a very general working rule, it is often assumed that a rise in temperature of roughly 20° F. will double the rate of a chemical reaction. Again, other variables the same, a high-temperature well will corrode more rapidly than a cooler well. Here, too, is another factor which may cause bottom-hole equipment in a given well to corrode more rapidly than the cooler surface equipment.

Composition of crude. Crude oils are extremely complex mixtures. Other than hydrocarbons, crude oil contains organic compounds of sulfur, oxygen, and nitrogen.

These compounds possess inhibiting characteristics themselves, and dependent upon the type and quantity present, an oil will itself possess certain protective properties. Many wells which produce high concentrations of acids are not corrosive owing to the natural protective ability of the produced oil.

Water-oil ratio. Consider for a mo-

ment a well, the oil of which possesses a given tendency to wet the subsurface equipment. When that well is new, and is making a relatively low quantity of water, it is often true that the natural film-forming agents and oil-wetting agents in the crude will prevent corrosion from occurring, assuming the oil film to be non-corrosive.

As the reservoir becomes depleted, water production generally increases substantially, and a point will be reached where the volume of water is so great that purely by virtue of its mass, that water will overpower the limited natural oil-wetting ability of the crude. Tubing, rods, and pump will convert from inhibited oil-wet surfaces to brine-wet surfaces. At this time, the well becomes corrosive, and requires that additional inhibitor and wetting agent be added from the outside in order that protection can again be established. This phenomenon is well understood, and studies in many oil fields have progressed to the point where it is known in advance at what water-oil ratio wells will start corroding.

Mechanism of corrosion inhibition in oil wells . . .

Corrosion can be controlled by any process which will prevent the acid-bearing brine from coming into contact with the surfaces to be protected. The semi-polar organic corrosion inhibitors are able to perform this function to various degrees. The degree to which these molecules are able to reduce corrosion is dependent upon several factors.

1. Nature of film. A semi-polar corrosion inhibitor has one or more polar groups within the molecule. These groups possess the ability to adsorb onto a metal surface, and dependent partially upon the magnitude of this polarity is the tenacity with which the molecule sticks. The tighter the adhesion, or adsorption, the longer will be the film life of an inhibitor. This means not only better protection, but also that treatment can be made at intervals of several days.

Actually, the polar group is an unbalanced electric force field, and this force field induces an opposite attraction between the molecule and the surface. There are a number of ways known to the chemist to impart this polarity to organic molecules. One of the primary objects of his research is to increase the magnitude of this property.

The organic semi-polar molecules may be thought of as molecules of oil or hydrocarbons, into which the chemist places atoms of sulfur, nitrogen, oxygen, or other electronegative atoms. These atoms confer polar properties upon the molecules at the spot in which they are located. The geometric shape of the hydrocarbon portion of this molecule can be almost unlimited. The hydrocarbon portion of some semi-polar molecules may be in the shape of a straight rod; or, it may have one or more branches like the limbs of a tree.

The chemist must be careful to place the polar groups in these structures at locations near the outside of the molecule so that they can get close to the surface upon which they are to adsorb. Otherwise, the polar group may be buried deep within the hydrocarbon portion of a highly branched chain, and its effect will be shielded from the metal surface. Thus, the research chemist not only seeks ways to make groups of maximum polarity, but he strives to place these groups within the molecule in such locations that they can exert a maximum effect upon the surface to be protected.

2. Extent of oil-wetting. All organic inhibitors possess one or more polar groups and the remainder of the molecule is a non-polar hydrocarbon residue. This residue is identical in composition to oil, or produced hydrocarbons. It is consequently miscible with, or in other words, soluble in, the oil phase.

To assume a simple picture of an inhibitor film on metal, consider the polar groups attached to the steel surface, and the hydrocarbon residues projecting outward from the surface of the metal into the produced fluids. Because these hydrocarbon residues are oil-like, they will attract produced oil to themselves with the result that in addition to an inhibitor film next to the protected surface, an additional film of produced oil will exist on the outer surface of the inhibitor film. This is an added advantage, when it is remembered that the corroding agents are in the water. There is both a layer of inhibitor and a layer of oil between the metal surface and the corroding phase, brine.

This phenomenon is, in a sense, related to oil-wetting, but oil-wetting refers primarily to a somewhat different idea. In most corrosive oil wells, metal surfaces are water-wet. Agents must be added to the system which will reverse this situation, and render the metal surfaces oil-wet and water-repellent. Chemical substances are the oil-wetting agents which confer upon the oil in the system the ability to displace water from the metal surfaces and coat these in turn with an oil film.

There are numerous reasons why oil-wetting is important. One lies in the fact that at every instant of time, inhibitor molecules are being lost from the protective film which they form on steel. This is partially a result of erosion by the produced fluids. However, the principal cause is the thermal energy of the adsorbed molecules themselves. These are in constant motion, partly of the molecule as a whole, partly as oscillations and vibrations of various portions of the molecule with respect to one another. This motion causes a molecule to "jump off" the metal surface every now and then.

It is necessary to periodically repair the inhibitor film by replacing the lost molecules. Remembering that an inhibitor film consists of a water-repellent (hydrophobic) outer surface which maintains a transitory oil film on top of itself, it is at once apparent that the film cannot be efficiently repaired if the mending inhibitor is dissolved in the water phase, for that phase is repelled by the residual inhibitor film.

By contrast, when the mending inhibitor is soluble in oil, and especially when that inhibitor enhances the ability of the oil phase to wet the surface, oil containing dissolved inhibitor will spread out over the remaining film residue and will give the fresh inhibitor the maximum time and proximity

SINGLE ZONE

to the surface which are so necessary for efficient film repair.

Good oil-wetting characteristics are also important in the establishment of a protective film in a well not previously treated. It is easy to see that even a partial film in a well which has been formerly treated will be quite oil-wet. However, when establishing a film on a new surface, it is actually necessary to displace water with oil.

By similar reasoning, it will be seen that oil-wetting properties will permit use of smaller quantities of inhibitor for the mending of partially desorbed films, for more of the inhibitor will have time to find its way to the metal surface prior to being produced out into the stock tank simply because of the better contact of the inhibitor-bearing oil with the surfaces to be protected.

Also, in very high water-oil ratio wells, the oil which carries the inhibitor is relatively small in volume, and consequently will need excellent spreading powers in order to coat the down-hole metal surfaces with fresh inhibitor.

Importance of uniform treating schedule . . .

It is customary to treat wells at intervals of several days. Assuming that all of the inhibitor at each injection is immediately flushed to the bottom of the hole and is produced up the tubing within a short period of time, then the protective film must be established during this time interval.

Once the inhibitor has passed out of the well, the inhibitor film starts a continuous desorption which does not end until the next injection of chemical. If chemical treatment is performed at intervals such that the film is still in good condition, a very minimum of inhibitor will be required in order to obtain excellent oil-wetting and consequently, high efficiency of repair to the film.

The result is a structure which does not corrode, even during part of the time, and further, a large reduction in the quantity of chemical required.

In the event that one or more treatments are missed, and the film residue is scanty, the normal treating volume which has been maintaining protection on the regular treating schedule will be insufficient to restore a protective film.

The pipe will be water wet and corroding. Skipping a few treatments, and then resumption of the regular treating amount and schedule may result in a corroding well even during the following period. It will be necessary to resort to a high slug treatment before the film can be repaired.

The interval between treatments is limited not only by the tenacity of the film formed, but also by another characteristic of organic inhibitors. All semi-polar inhibitors possess inherent tendencies to aggravate brine-oil emulsions. This undesirable occurrence is especially prevalent with initial heavy slugs in wells when first treated. In some cases, heavy treatments at fairly long intervals have been substituted for light treatments at more frequent periods, with consequent increases in basic sediment and water.

Thorough flushing necessary. The most necessary part of a good treating program is thorough flushing of inhibitor by well fluids. The best way to demonstrate this fact is by actual case history.

On February 1, 1953, a selected group of more than 500 sour wells in Kansas were set aside for a special study. These wells had been treated with very good success for several years prior to February 1, 1953, and it was considered that maximum results and minimum treatments had been established.

Purpose of the project, however, was to determine if more precise treating practices could not achieve better results. On February 1, 1953, treatment in all the wells was cut exactly in half. At the same time, a four-week schooling program for the pumpers of the involved leases was held in the field, where the importance of routine treatments and thorough flushing of product was emphasized.

On February 1, 1954, a survey of all well failures attributable to corrosion during the controlled 12-month test showed that well failure has decreased by 35 percent during that period in spite of the fact that the quantity of inhibitor used was just one half of what had been previously used and that the equipment was another year older.

The following is an incident which was encountered in the field and illustrates an extreme in poor operating practice. A large lease in Kansas was divided by a highway. Very low corrosion failures were noted on one pumper's half of the lease, while two and three workover units were always on location across the highway.

An engineer, when calling upon the men beset with troubles, asked how his inhibitor injection program was faring. The pumper, in all sincerity, was very frank in stating that he was unable to get his inhibitor program on a routine schedule because his time was consumed almost entirely by

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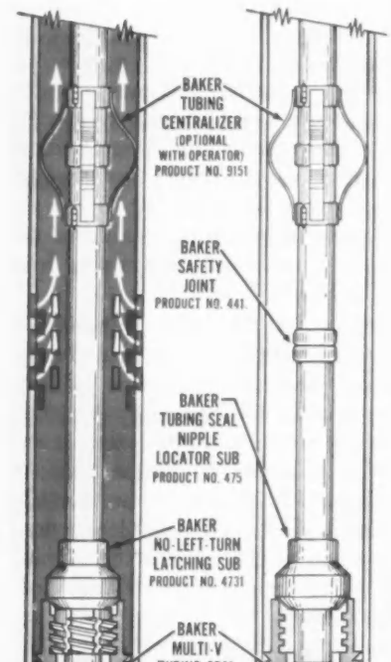
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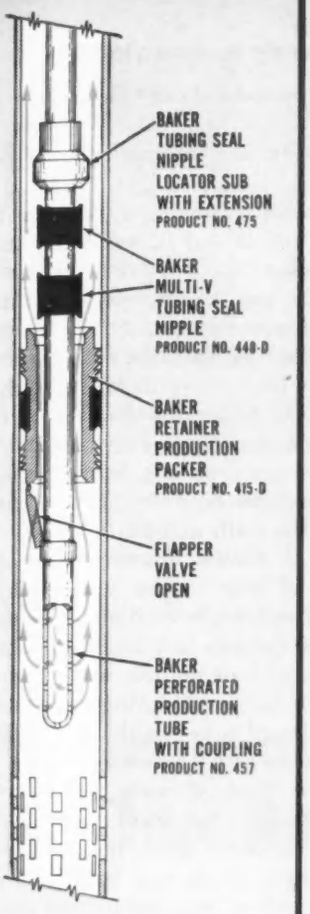
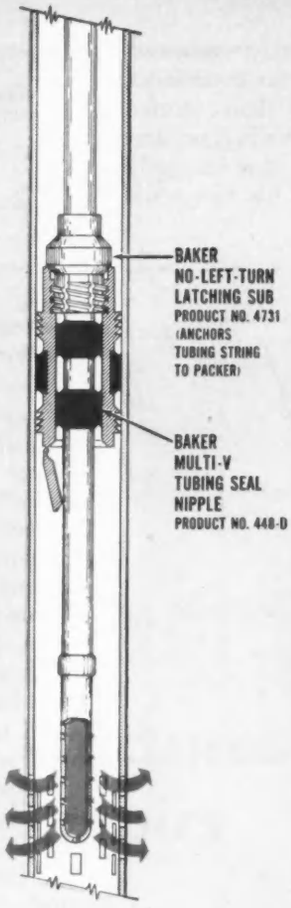
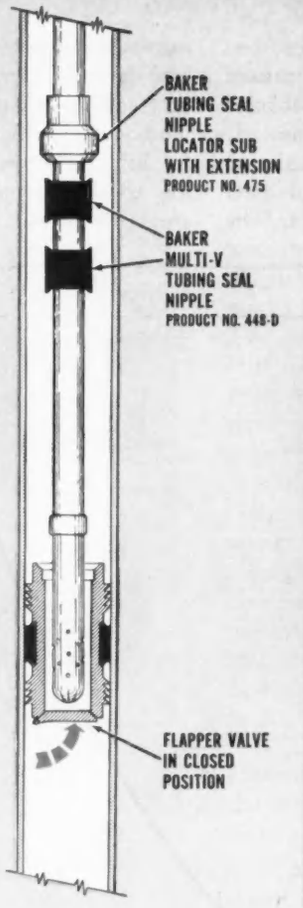


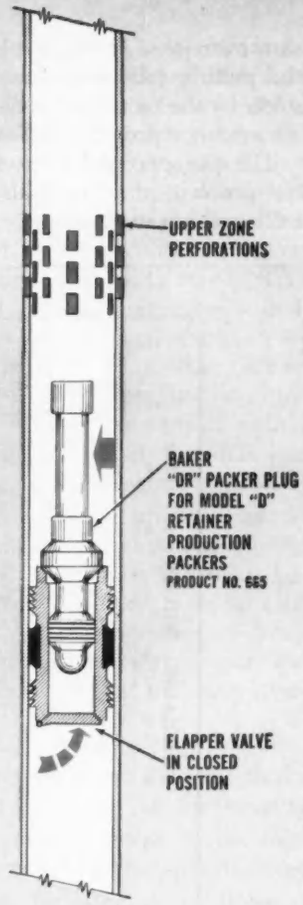
Washing or Circulating Tubing Seal Nipples removed from packer bore. Flapper Valve held open by tubing extending below Tubing Seal Nipples.



Pressuring Below Packer Acid or cement squeeze, formation fracture, gas or water injection. Latch Sub used when squeeze pressures exceed tubing weight.



Isolate Zone Below Packer Tubing String removed, Flapper Valve closed. Isolates pressure differentials (squeeze, productions) from below the packer.



Temporary Bridge Plug For working over zones above packer. DR Plug run in on Baker Retrievable Cementer, and retrieved with overshot. *Permanent Bridge Plug* can be formed with Trip Bob (not illustrated).

RESISTS CORROSION —The cast-iron used in the construction of Baker Packers is far more resistant to corrosion than the casing in which the packer is set, thus making it ideal for permanent installations, or for use in areas plagued with a severe corrosion problem.

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IMPORTANT FACTS

Baker Packers are used in a majority of installations where conditions of extreme pressure, temperature, or depth are present. Baker Packers also dominate Dual Zone installations, particularly those involving two-packer, crossed-flow arrangements.

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workover jobs. It was explained that the pulling jobs were an evil caused solely by the fact that he did not have his inhibitor program under way.

The pumper had lived so close to his problem that he had failed to realize this rather obvious fact. The pumper and engineer then spent several days together, and the importance of treating was clearly demonstrated. Today, the pumper who had no time for inhibitor injection, now has nothing to do but gauge his tanks and treat his wells.

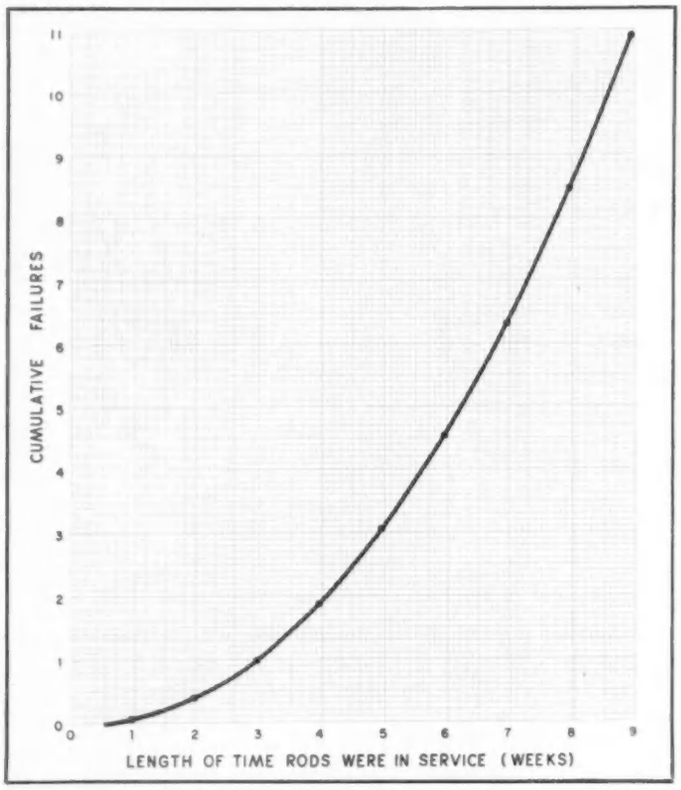

Fig. 1.—Cumulative effect of corrosion on frequency of rod failures is present graphically in a severely corroded well in West Texas.

Age factor in corrosion failures . . .

A common misunderstanding regarding the manner in which equipment corrodes with time has lead many to believe that a given corrosion inhibitor will work in a well for a period of perhaps several months, then becoming ineffective in that well. In other cases, an operator has changed products and observed that well failures were more frequent with the product last used. This information alone is no criterion that the former product was superior to the one last used.

The Bureau of Standards conducted an immense project which required nearly 15 years to complete. The project was to determine the manner in which various soils corroded mild steel pipe. Thousands of pieces of pipe of different diameters and lengths were buried in many types of soil. Certain numbers of these were dug up each year and examined for corrosion. This work proved very decisively that the following relationship holds for any structure which is corroding at a constant, unchanging rate:

> cumulative failures = k (age of equipment)^n, where n is greater than 1. This is a parabolic curve symmetrical with the vertical coordinate.

In order to clarify this phenomenon, consider a very severely corrosive well in West Texas, in which new rods were experiencing about three failures per week at the end of a ten weeks period. These data are represented approximately by the equation:

> cumulative rod failures = 0.1 x (age of rod)$^{2.14}$

These data are summarized in Figure 1.

One inhibitor was used throughout the test, and is can be assumed that the corrosion rate was fairly constant during the entire ten weeks period. This extreme example demonstrates clearly that the frequency of failure constantly increases with time. Nearly three weeks elapsed before the first rod failure occurred. Providing that failures versus time is a linear curve, one failure can be expected to occur between the sixth and ninth weeks.

Figure 1 shows, however, that at the end of nine weeks, 8.6 failures had occurred, while at the end of six weeks, 4.6 failures had occurred. The difference of four failures is the number which occurred during the three weeks interval between the sixth and ninth weeks.

Suppose that at some period of time following the third week and prior to the sixth week, the operator had changed from one inhibitor to another, and to keep the picture simple, assume that the second inhibitor was exactly as effective as the first. Then the same curve as shown in Figure 1 would have been obtained.

However, if it were not known that these failures are a parabolic function of the time the equipment has been in service, it would be assumed that the second inhibitor was much less effective than the first. This is an unjust conclusion.

In addition to this relationship, it must be remembered that curves such as Figure 1 only can be obtained from a large number of case histories which will give us a statistical trend. Pulling jobs in a single well will be quite erratic in general and will not show a uniform increase with time.

Therefore, it is clear that to correctly evaluate any corrosion mitigation program, it is essential to conduct controlled tests in a large number of wells over a period of time sufficient to give a definite, continuous trend, generally a period of several months. The accumulation of such large amounts of data can be analyzed mathematically in order to determine an equation such as (1) for different methods of corrosion control. Differences in the exponent of time is the true measure of differences in corrosion control programs. —**The End**

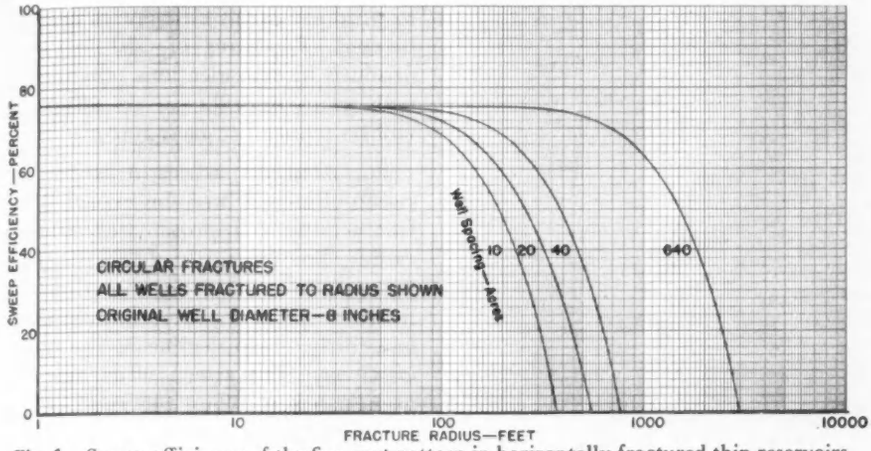

Fig. 1—Sweep efficiency of the five-spot pattern in horizontally-fractured thin reservoirs.

Water-flooding and gas cycling affected by . . .

Horizontal Fractures In Thin Reservoirs

Part 4: Sweep Efficiencies of the five-spot pattern.

By DR. PAUL B. CRAWFORD, Texas Petroleum Research Committee, College Station, Texas

THE CIRCULAR horizontal fracture is one that may occur by fluid fracturing processes, in that the fracture originates at the well and extends outward into the reservoir somewhat like a "pancake." It has a high permeability compared to the matrix proper.

The opinion has been expressed by some that the creation of fractures may lead to channeling and bypassing; others have expressed the opinion that the creation of fractures may have little effect on secondary recovery or pressure maintenance programs. Primarily for this reason, work was initiated to estimate the effect of circular or "pancake" fractures on the sweep efficiency of the five-spot pattern.

The problem. The sweep efficiency of the unfractured five-spot pattern was originally presented by Muskat and Wyckoff,[2] and later expanded by Hurst.[1] Horizontal fracture problems have had only preliminary examinations and a portion of the results is indicated here. Potentiometric model studies of thin reservoirs indicated that if circular horizontal fractures exist at each well, the periphery of the fracture constitutes a circular isopotential. For the case in which the thickness of the electrolyte divided by the well spacing was very low (0.022) it was found that isopotentials along the surface of the conducting medium were substantially those along the bottom of the medium regardless of whether the fracture was along the top, in the center or on the bottom of the reservoir. It was found that the sweep efficiencies for these cases were approximately equal to the sweep efficiencies which were observed for the unfractured system minus the percentage area of the horizontal fractures at the input and the output wells.

These data were checked for the case of simulated 74.5 and 155 foot fractures occurring at each well on the potentiometric model. Agreement between the calculated method and that shown by the potentiometric model was within two percent. This is believed to be near the precision of the particular potentiometric model and analytical procedures used. The sweep efficiencies, which represent the percentage of the pattern area swept out when the injected fluid first reaches the output well is a partial indication of the effectiveness of the fluid displacement process.

On the basis of the apparent agreement between the potentiometric model and the calculated results, additional work has been done to estimate the sweep efficiencies of horizontally fractured reservoirs for the case of 10, 20, 40 and 640-acre spacings.

Five-spot efficiency. Figure 1 shows the sweep efficiency of horizontally fractured thin reservoirs for the five-spot pattern. This sweep efficiency might apply for either water flooding or gas cycling. It was calculated on the assumption that all wells are fractured; the mobility ratio is one; steady state conditions exist, and the ratio of the thickness of the reservoir divided by the well spacing is less than 0.022. The data will apply to a ten-acre spacing when the thickness of the pay is approximately 15 feet, or would apply to a 640-acre spacing when the thickness of the pay is approximately 115 feet. Corresponding thicknesses may be calculated for either 20- or 40-acre spacings.

A sweep efficiency of substantially 72 percent will be achieved for fractures up to 30 feet in radius for the case of a ten-acre spacing. A sweep efficiency of the same order of magnitude is expected for fractures up to 300 feet for the 640-acre spacing. It will be noted on the ten-acre spacing that when fractures of 100-foot radius exist at all wells that a sweep efficiency near 64 percent is expected. When fractures of 150-foot radius exist at all wells a sweep efficiency near 54 percent has been calculated.

For fractures greater than this, the curve drops off very sharply, in that fractures of 200 feet are expected

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to produce sweep efficiencies near 40 percent. Fractures of 330 feet will produce interconnections, channeling will occur, and the sweep efficiency will be reduced to near zero.

For 20-acre spacings, a 71 percent sweep efficiency may be expected for fractures up to approximately 40-foot radius. For fractures of 200 feet the sweep efficiency is estimated to be near 56 percent, after which there is a fairly sharp decline in the sweep efficiency. The sweep efficiency will approach zero when the radii of the fractures approach 470 feet. In a 40-acre spacing fractures of up to 80 feet in radius are expected to result in sweep efficiencies near 71 percent. Fractures of 300 feet are expected to result in sweep efficiencies near 54 percent. From this radius outward the sweep efficiency drops off very sharply, as with the other patterns.

For the 40-acre spacing the sweep efficiency is reduced to zero when the fracture radii approach 660 feet. The 640-acre spacing indicates that substantially 71 percent sweep efficiency will be observed for fractures up to 300-foot radius. Sweep efficiencies of 54 percent are expected for the case of 1200-foot fractures, after which the sweep efficiency declines very rapidly as the radius of the fracture increases. If the radius of the fracture approaches 2640 feet, the sweep efficiency is reduced to near zero.

In previous work it was indicated that creation of fractures of greater than 150-foot radius for a ten-acre spacing were expected to produce uncertain and erratic results. This will be noted on the figure. Note that the 150-foot fractures produce sweep efficiencies of 54 percent, after which the sweep efficiency declines very rapidly. Fractures between 150 and 330 feet occur in a very steep region on the sweep efficiency curve. Consequently, this region has been termed a region of uncertain performance.

Approximate corresponding radii for 20, 40 and 640-acre spacings are approximately 210, 300 and 1200 feet respectively. Prior work has also indicated that for a ten-acre spacing, a fracture between 30 and 50-foot radius may be desirable. Fractures of 30 to 50-foot radius may be expected to result in sweep efficiencies near

70 percent. Less element of risk is involved in creating the shorter fracture, and the conductivity of the fracture of 30 to 50 feet is expected to be approximately three to four times that of the unfractured system. For the 20-acre spacing fractures from 40 to 75 feet may be desirable. These fractures will result in an increase in pattern conductivity by a factor near three or four.

The sweep efficiency will be approximately one percent less than that for the case in which no fracture occurs, and the risk element is reduced. Comparable fractures for the 40- and 640-acre spacings are near 60 to 110 feet and 225 to 425 feet, respectively. For the above conditions fracture conductivities will be increased by factors of three to four, sweep efficiencies will be high, and the element of risk in creating fracture interconnections will be minimized.

Conclusions. The estimated sweep efficiency of a horizontally fractured five-spot pattern has been studied for the case of thin reservoirs with well spacings of 10, 20, 40 and 640 acres. Fractures up to 50 feet in radius will effect a small decrease on the sweep efficiency for the above spacings. For the case of ten-acre spacing, creation of fractures greater than 150-foot radius at each well will involve some element of risk, and the sweep efficiencies may be reduced to very low values. Desirable fracture lengths are indicated to be near 30 to 50 feet, 40 to 75 feet, 60 to 110 feet and 225 to 425 feet for the 10, 20, 40 and 640-acre spacings, respectively. The preferred radius will depend on the reservoir, economic conditions and ultimate objectives: If it becomes possible to create fractures with a precise radius, fractures outside the above range may be desired in some instances.

Prior to the initiation of a waterflooding or gas-cycling program it is suggested that studies be made to estimate the extent of the fractures. If they do not appear to be in a favorable range, remedial action should be considered.

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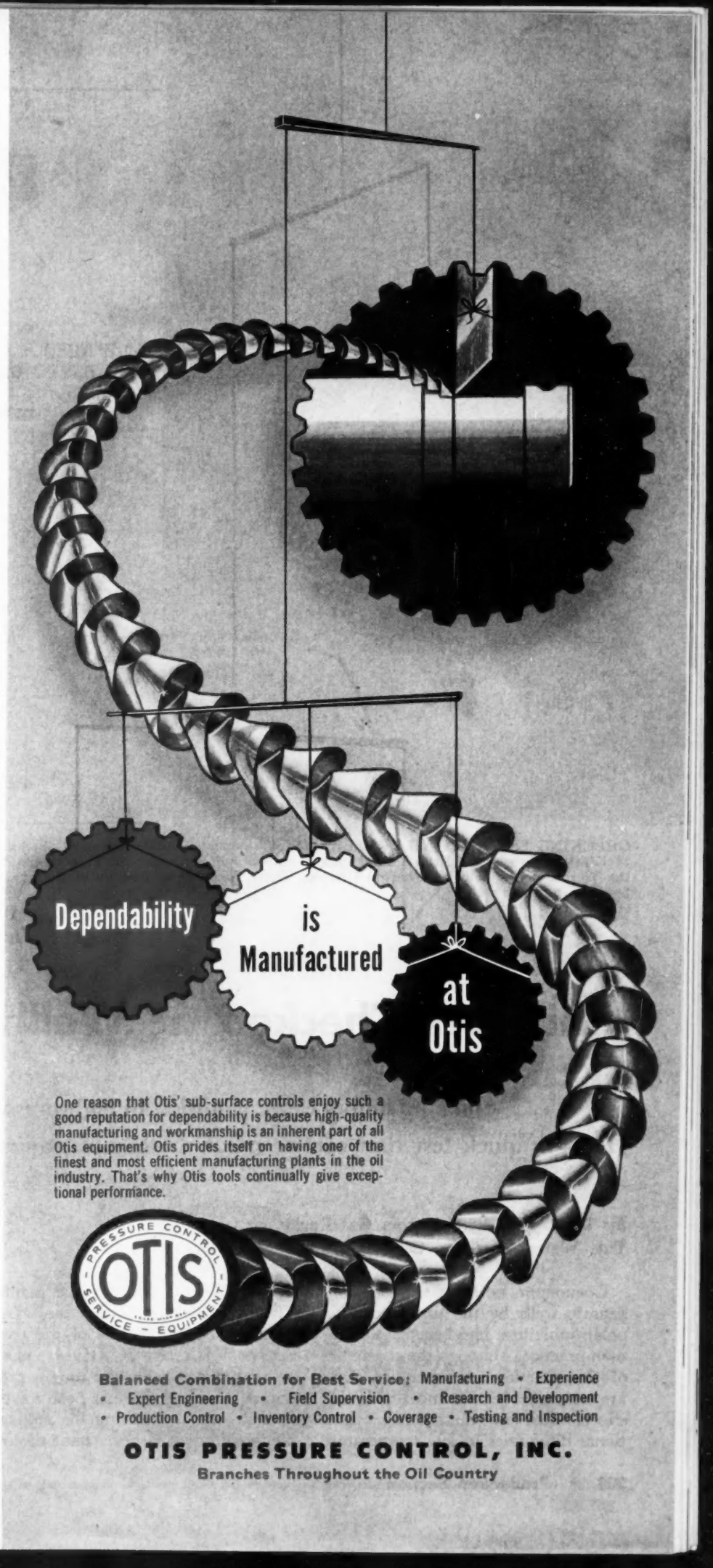
To Be Continued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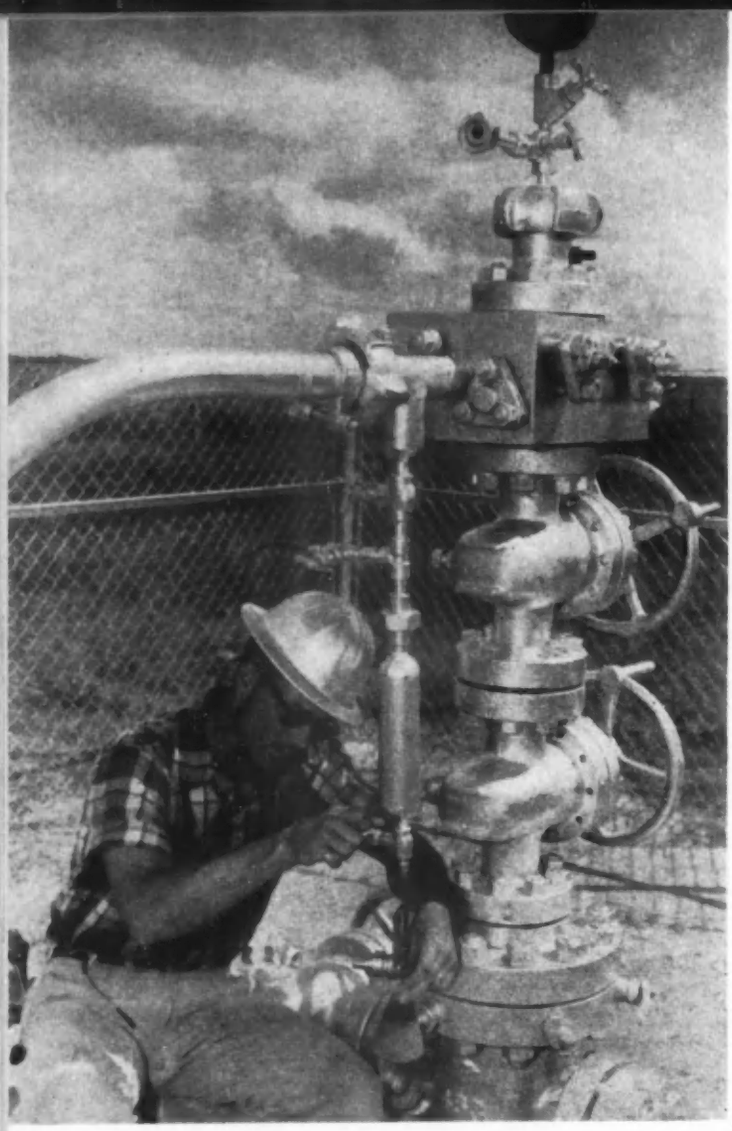
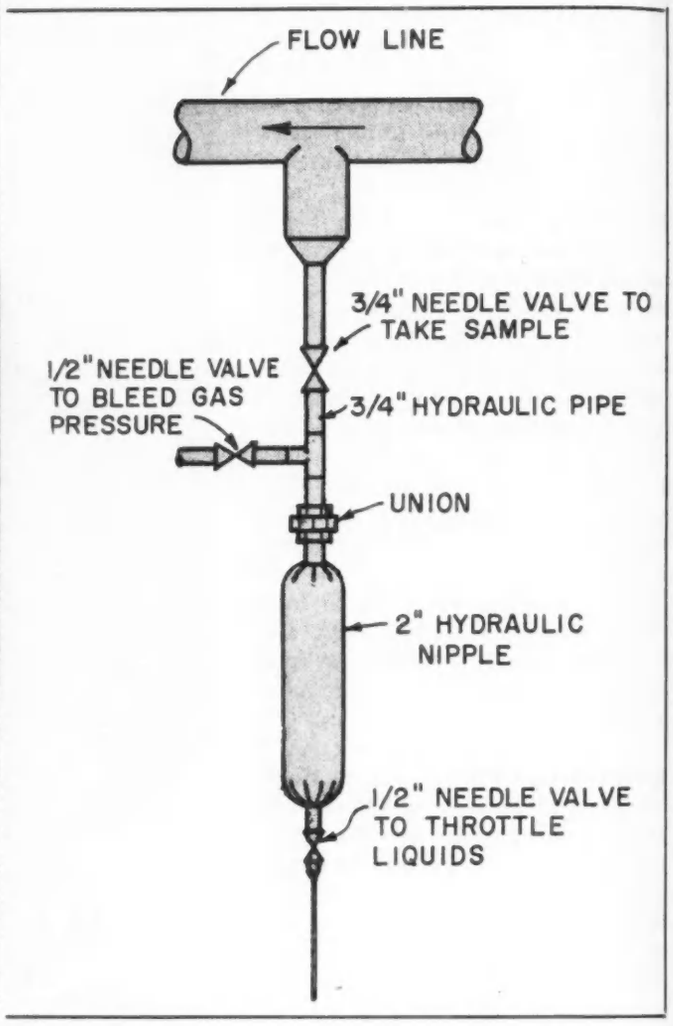



FLOW LINE
3/4" NEEDLE VALVE TO TAKE SAMPLE
1/2" NEEDLE VALVE TO BLEED GAS PRESSURE
3/4" HYDRAULIC PIPE
UNION
2" HYDRAULIC NIPPLE
1/2" NEEDLE VALVE TO THROTTLE LIQUIDS

CHECKING EMULSIFYING PROPERTIES of a corrosion inhibitor under operating conditions. Corrosion control man Joe L. McKinzie, who suggested this testing idea, is shown running a test on Tide Water Associated Oil Company's C. B. Stephen's 1 in the West Bernard field of Wharton County, Texas. Right is a diagram of testing apparatus which is installed on gas condensate flow line near the well.

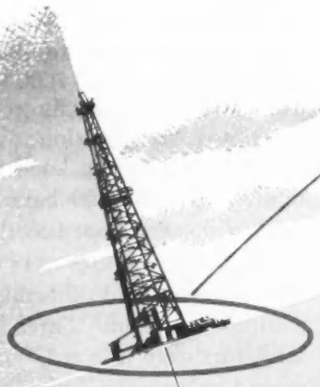
Inhibitors Checked at Wellhead

Some inhibitors cause emulsion in high-pressure condensate. Here's a quick test that can be made under operating conditions.

By D. R. FINCHER, District Gas Engineer,
Tide Water Associated Oil Company, Weimar, Texas

CORROSION CONTROL in gas condensate wells by the use of organic polar inhibitors has become a common practice. Although the economics of this practice are favorable, there are sometimes certain undesirable side effects which have caused many operational difficulties in low temperature separation units and gasoline plants. The problem that occurs most frequently is emulsification of the condensate with the relatively small amount of connate water usually produced. This problem has been solved to a degree by reducing the amount of inhibitor used, or changing inhibitors. Inhibitor manufacturers have produced inhibitors designed to alleviate this problem, but some of the inhibitor variations have not been entirely satisfactory.

Tide Water Associated Oil Company operates a gasoline plant in the West Bernard Field of Wharton



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to operate hydraulically the time proved standard bottom hole pump!

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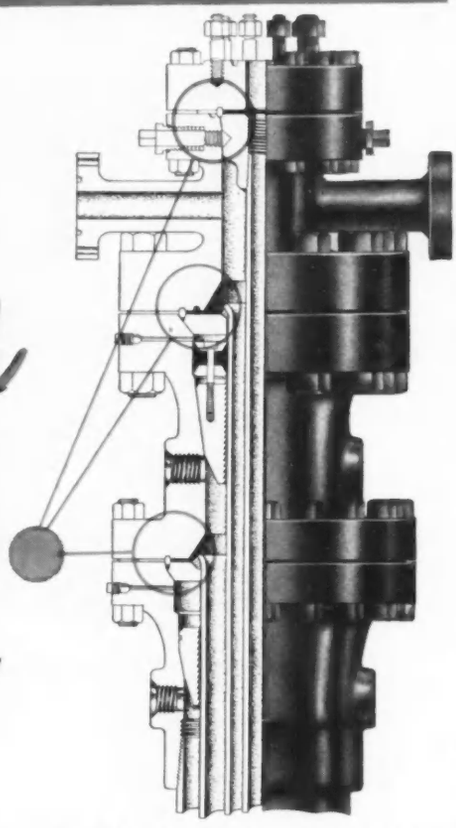

Assembly of Type "RH" Rectorhead Casing Heads with three Casing Strings and Type "M" Tubing Head. Notice how welding ring seats in head body. API Ring Gasket completes the "seal-with-steel."

You wouldn't think of using soft packings between flanges or flanged fittings, particularly where temperatures and pressures are high. Then why use them in casing or tubing heads, where conditions are even more severe, and leaks more disastrous.

When you use Rectorheads you "seal-with-steel." The welded seals, plus API Ring Gasket, never require replacement or maintenance, will not "flow" under high pressure or temperature, will not "freeze" or contract under low temperature, will not burn out or deteriorate. The Rector Welding Procedure is covered in API Std. 6E., Third Edition, January 1952.

Why risk soft seals in your well heads when you don't use them in flanges? Specify Rectorheads and you can "seal-with-steel" between casing strings.

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RECTORHEAD RECTOR CEMENTING METHOD RECTORSEAL

County, Texas, which is a corrosive gas condensate field. The wells connected to this plant produce from the Yegua series at about 7000 feet. When these wells were initially treated with inhibitors, an emulsion was experienced in the water knockout which resulted in about 50 barrels of condensate being dumped to the pit. Inhibitor injection rates were varied but this program did not alleviate the emulsion problem. Three additional inhibitors were injected, but each one caused an emulsion.

When these inhibitors were put in the wells, the emulsion appeared in 4 to 6 hours after injection. It was sometimes as high as three days before operations were again normal. After treatment, the emulsion was carried into the process equipment, and a considerable quantity of condensate was emulsified in the waste water stream to the pit.

It became apparent that the corrosion control program was going to interfere with operations to the extent that it would be impractical to continue the use of inhibitor. It was also impractical to continue to put inhibitors in the well in an attempt to find one that did not cause emulsification.

Testing inhibitors. The test procedure was to obtain a sample of produced condensate and water from a reservoir and mix the inhibitor with the condensate in the sample pot. The concentration used was the maximum expected in the well stream. Produced water was added to the sample and the wellhead pressure was admitted to sample pot. The gas was then vented and the mixture drained to see if emulsification occurred when the pressure was applied. Some inhibitors will cause emulsification under these conditions.

In the event the sample did not emulsify, the liquid sample containing inhibitor, produced water, and condensate was poured into the sample pot the second time and pressured again. The next step was to remove the fluid by throttling the liquid through the bottom valve of the sample pot. The sample was then observed for emulsification and the tend-

ency for the condensate and water to separate.

Thirty-seven inhibitors were tested in this manner and only one inhibitor appeared satisfactory. On the basis of these tests, a well was isolated so that it could be produced to a test separator to observe the effect of inhibitor injection. After treating the well for three weeks with no adverse effects, inhibition was begun in all the wells. The field has been under treatment for three months and there has been no emulsion problem.

It was found by additional testing that the emulsion problem varies with the formation. An oil soluble, water dispersible chemical, with water as a diluent or carrier, had to be used in a majority of the West Bernard Field wells, which were completed in the Clodine Sand. Tests of this inhibitor in other formations indicated the inhibitor should be carried in condensate to prevent emulsification. These tests also showed that it is quite likely for emulsion to occur where wells treated with different inhibitors are produced to common lease facilities or a plant.

Since this test procedure had eliminated the emulsion problem in the West Bernard field, it was decided to check the problem in other fields. In the Sublime field, Colorado County, Texas, it has been necessary to employ emulsion breaking compounds for several years. A series of tests were made which showed that by using a certain corrosion inhibitor, the emulsion problem would be lessened. Approximately one month after this inhibitor was first used it was no longer necessary to use emulsion breaking compounds.

Test is useful. This type of test is useful in selecting inhibitors for new wells as well as solving the problems caused by inhibitors. However, the primary function of a corrosion inhibitor is to retard corrosion and the performance of the inhibitor in this respect should be closely watched. In these cases the inhibitors chosen have proved to be satisfactory in controlling corrosion. It is concluded that by field testing, a corrosion inhibitor may be selected which does not cause undesirable side effects, and in some instances may eliminate the use of emulsion breaking compounds. —**The End**

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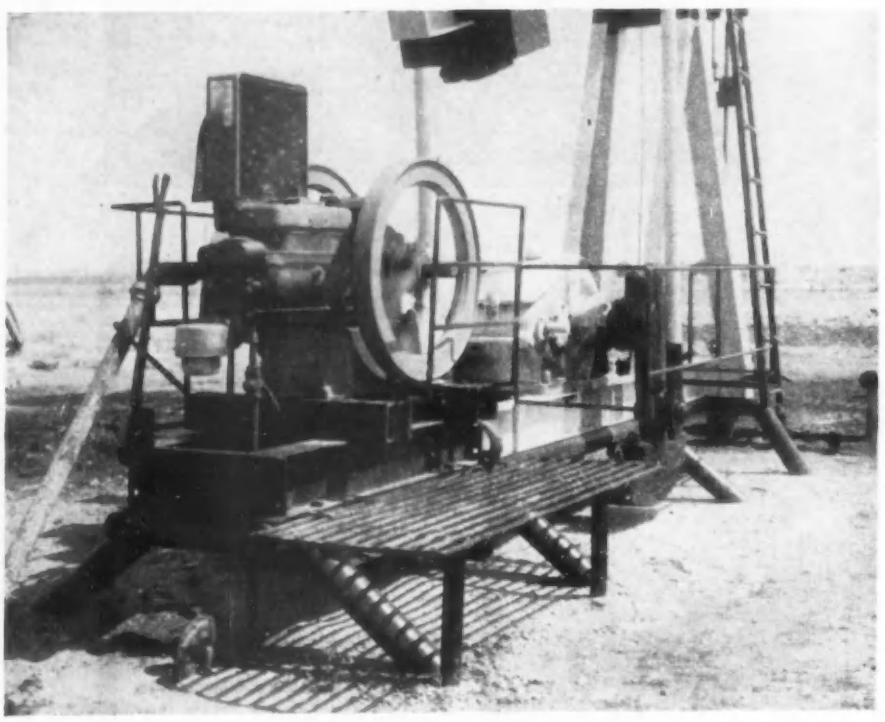
(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

How to do it

PRODUCTION HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas



Pipe Frame Foundation Can Be Buried

The problem of moving pumping units and breaking up a concrete foundation was solved by one producer by burying the pipe frame foundation. This pumping unit foundation was not of the universal type, that is, it was not designed to accommodate several size units. Therefore, when it was necessary to move the unit, the foundation had to go with it.

The foundation for this pumping unit is made from three-inch diameter pipe and welded together, except for the bolts holding the pumping unit skid to the pipe framework. Instead of vertical supporting legs, this foundation has angle supports to provide rigidity. These supports terminate at long pipe runners forming a box frame that rests on concrete pads about 18 inches underground. The unit merely rests upon the concrete pads, and is covered over with dirt up to ground level. This provides ample strength and anchors the unit properly.

When a move is necessary, the dirt is removed, the pumping unit disconnected from the rods, and the unit loaded on a trailer. A grating made of sucker rods is added around the engine to provide safe footing for pumpers who must start and stop the engine as well as maintain it. An integral guard rail system incorporated into the pipe foundation keeps stock from being hurt by the moving machinery.

Ball and Seat Regulates Back Pressure on Line

On pumping wells where the engine is run off of the gas produced by the well, or where a low but constant pressure is to be maintained on the casing, particularly in cases where total volume is comparatively low, it sometimes is not practical or economical to equip the line with a regulator or other pressure control equipment. One operator found that he could maintain a constant pressure on the line by equipping the system with a salvage ball and seat taken from a sub-surface pump. Installed at any desirable point in the line, this unit easily can be installed with a few nipples and fittings normally available at the lease.

The weight of the ball is sufficient to hold a few ounces pressure on the system and, should the well go down or, for some other reason, pressure should increase in the line, the ball will raise up off the seat, allowing gas to escape until a lower pressure is reached, at which point the ball will fall back onto the seat and prevent further escape of gas. The ball will flutter at times, but this in no way interferes with the maintaining of a constant pressure. It is important, however, that the ball and seat be reasonably well fitted or lapped so a gas-tight seal will be maintained when the ball is down. The unit may be enclosed with a screen or mesh hood to prevent wind-blown straw or dirt from fouling the ball and seat.

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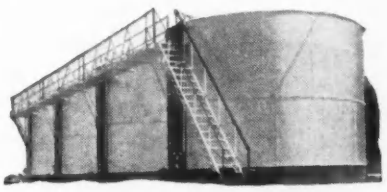

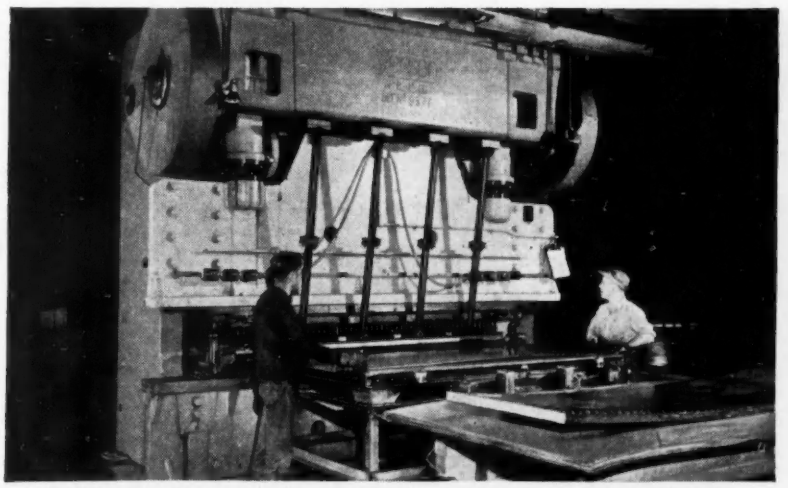

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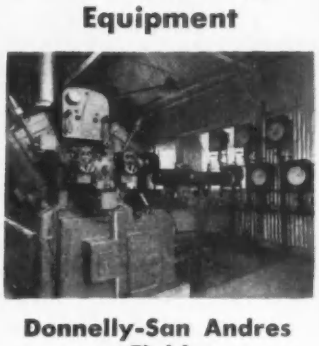

Donnelly-San Andres Field Ector County, Texas

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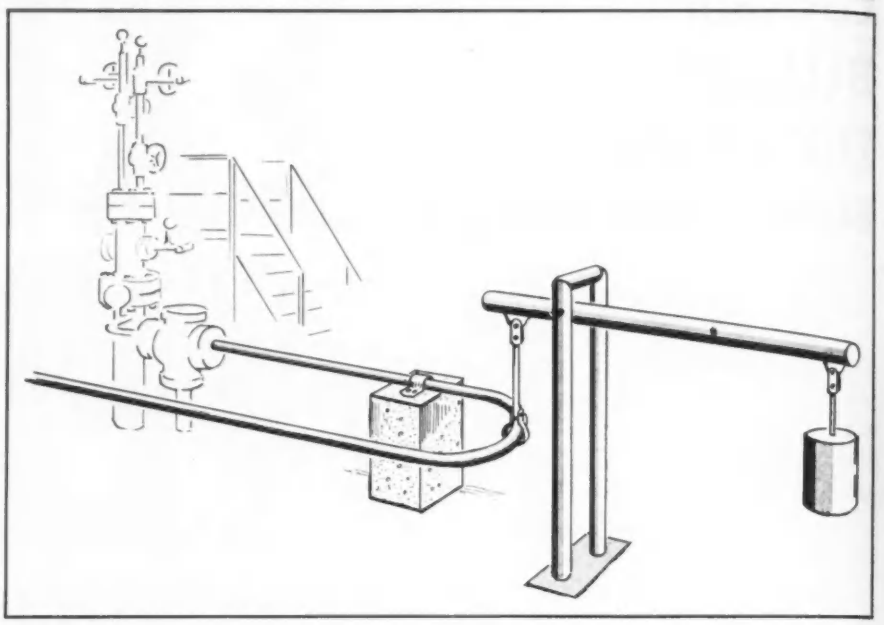

Counterweight Supports Expansion Loop

High-pressure gas wells have been equipped with expansion loops on the heavy-duty flow lines to compensate for contraction and expansion due to temperature changes. By permitting the line to expand and contract freely, the danger of breaking a fitting or a flange seal is thereby lessened.

Illustrated is an effective yet simple method of supporting one end of an expansion loop and at the same time providing sufficient freedom of movement in the line. It is a counterbalancing device made of four-inch and two-inch pipe.

Pour concrete foundation to provide adequate footing for the two supporting legs. Weld these legs, of two-inch line, in the shape of a long "U" with just enough space separating them so the four-inch horizontal arm can be hinged between them with a heavy steel rod. The rod is held in place by cotter pins.

Weight of the expansion loop is counterbalanced by a pot of hardened

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the dependable, economical water treater

CHECK THESE FEATURES:

- Used in Oil Well Water Flooding, Municipal Water Treating Plants, Canneries, etc.
- Can be driven by water entering plant for treatment.
- Maintains pre-set water-chemical ratio through a wide rate-of-flow range.
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- Also can be equipped with electric motor, or gas engine drive.
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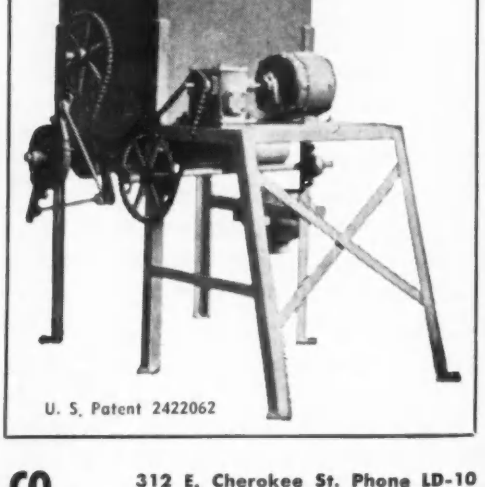
For complete description see Page 2630 of the Composite Catalog.



U. S. Patent 2422062

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312 E. Cherokee St. Phone LD-10
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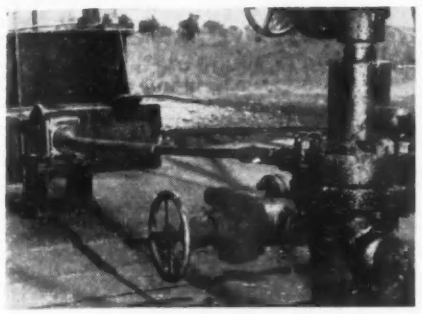
cement poured in a short section of casing. A connecting arm with an eye holds the cement weight to the long distance arm by means of a link. A similar link welded to the shorter arm is attached to the expansion loop by a pipe clamp. No maintenance is required, and if the loop is to be removed from the wellhead, little time is taken is to disconnect it from the counterbalance.



Pumping Unit Setup Rotates Tubing Strings

Reciprocal motion of the walking beam is transferred into rotative motion to provide the power necessary to turn the tubing string. By rotating the tubing string as the well is pumped, sucker rod wear against the tubing is evenly distributed to increase the useable life of a tubing string.

This unique method of rotating the tubing consists of a gear box, a drive shaft and a differential gear assembly incorporated in the tubing head. Reciprocating motion of the walking beam is transferred to the gear box, shown in the background, by means of a half-inch rod clamped to the walking beam at one end and fastened to a crank arm on the gear box. A rachet on the crank drives a notched wheel of the gear box which is geared down to rotate the drive shaft. Length of the crank stroke is adjusted so that about one revolution of the tubing is made each day.

End of the drive shaft enters a stuffing box on the tubing head and terminates in a helical gear. This gear in turn rides on a ring gear fixed to the tubing which floats on bearings. As the drive shaft rotates, the tubing is slowly turned through the gear arrangement so that wear due to contact with the sucker rods is distributed over the inside circumference of the tubing. In this manner, life of tubing strings has been extended in fields where crooked wells exist.

The most flexible, least expensive method of pumping oil wells is the

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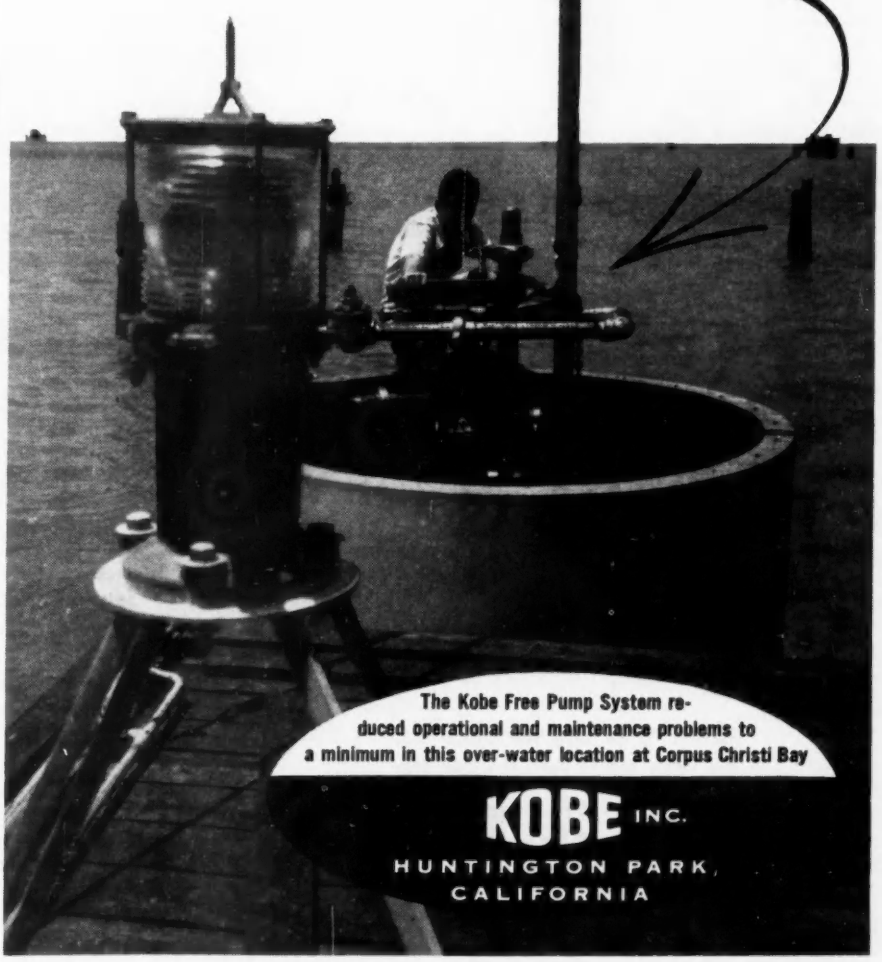

The Kobe Free Pump System reduced operational and maintenance problems to a minimum in this over-water location at Corpus Christi Bay

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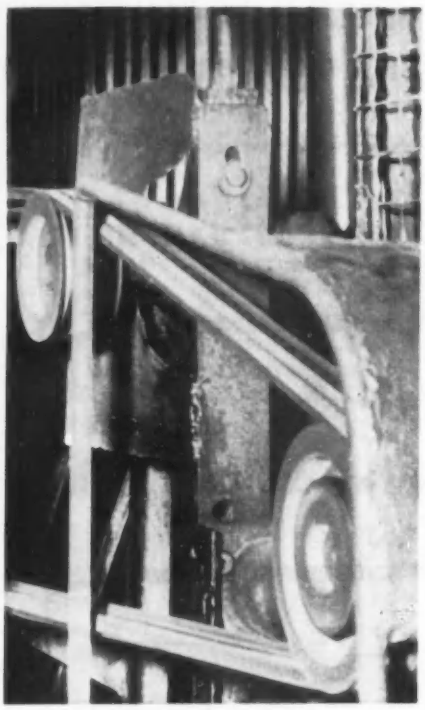
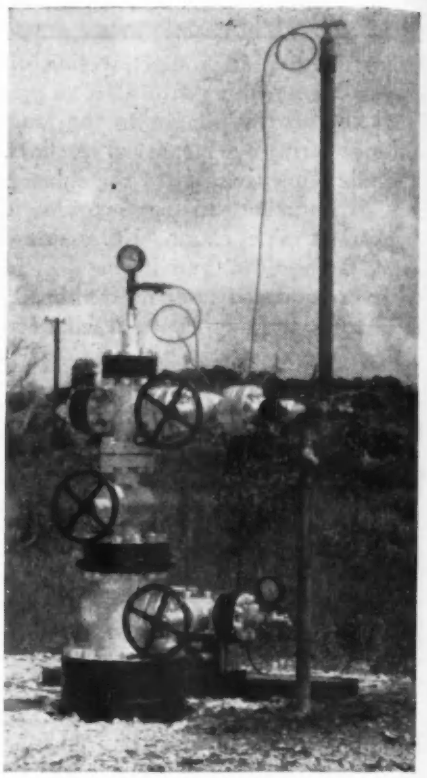


Adjustable Idler Keeps Proper Belt Tension

On V-belt installations where the distance between the driving and driven sheaves is relatively large, it is desirable to use an idler sheave. Purpose of the idler sheave is to prevent the belts from "slapping," and to maintain proper tension in the belts. A simple and effective way to make the idler sheave adjustable is shown.

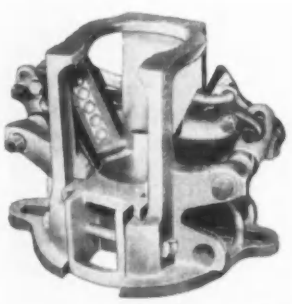
Channel iron welded in the form of an A-frame so that one leg is vertical and the other placed at an angle support the sheave. The adjustable feature bolts to the vertical leg as shown. The sheave is attached to a metal housing which fits onto and is bolted to the vertical leg. Notches cut into one side of this housing provide holes for the attaching bolts. The notch, about two inches long, makes movement of the housing possible. The housing may be lifted or lowered in these notches as desired to provide the desired tension in the vee belts.



Flow Line Gas Powers Chemical Injector Pump

Gas from the downstream side of the flow line choke on this flowing producer provides the power to inject chemical inhibitors back into the well. The problem of supplying liquid-free gas to the inhibitor pump was solved by placing a vertical section of flow line to a tee where the line leads underground.

This scrubber section is about five



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2 **FULL CIRCLE SLIPS:** Conventional type slips for extra long strings and parallel strings fully protect the tubing against crushing.

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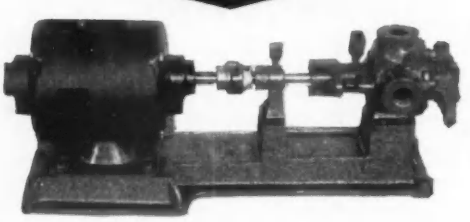

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How would you like to receive 50 million small hammer blows? . . . Well, that's just how many times the ball chatters against the guides of a Martin Cage in one year. Where other cages are beaten and worn out by this punishment, Martin Cages are little affected. The secret of Martin Cage's long life is the rubber ball guides. The resilience, resistance to sand abrasion, nonmagnetic character, and electrical resistance of this rubber guide successfully combat cage problems . . . Yes, you'll solve **your** cage problems with a Martin Cage . . . the finest cage made today!

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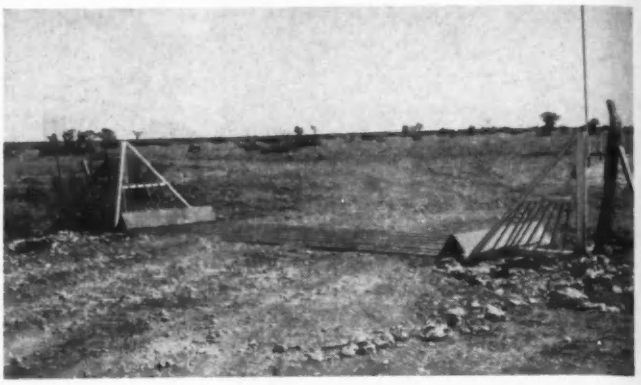
feet long, the top of which is equipped with a collar and a reducer. Copper tubing attached to a valve in the reducer conveys gas to the inhibitor pump. By extending the flow line into the air as shown, liquids in the line remain on the bottom where they are carried to a tank battery via the flow line.

This arrangement solved an otherwise difficult problem of providing power gas to inject chemicals into the well. Complicated and more costly scrubbers were eliminated, and the installation illustrated is compact.

Angle Iron Makes Curb for Cattle Guard

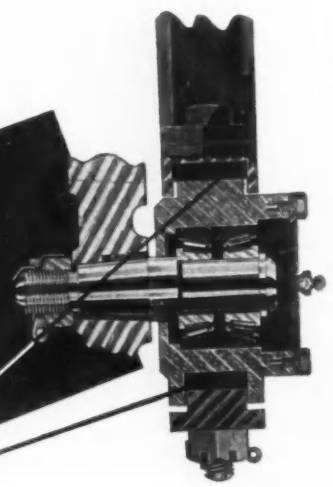


Addition of a sturdy curb to either side of a standard-type cattle guard prevents heavy trucks from bending or tearing up the end sections. When large loads are carried by truck onto producing leases, occasionally the driver will not stop to gauge his clearance on cattle guards and the result may be a damaged end section, plus damage to truck or load.

Tack-weld two ten-foot sections of large-size channel iron to the iron rail members at the extreme ends of the guard. This angle iron curb makes the driver keep the truck wheels inside the curb, and thereby provides greater clearance between the end sections of the cattle guard and overhanging loads on the truck.

JENSEN'S WRIST PIN ASSEMBLY . . .

ABSORBS THE SHOCK!



Further proof of JENSEN'S superior construction. The bearing housings of the wrist pin assembly are cleverly designed with a heavy compression type rubber strip located above and below the bearing to absorb shock and vibration from the well load. Stroke length changes are made easily and quickly. Wrist pins are cut from alloy steel and taper fitted to the crank. Get complete details on all JENSEN features—write us or see your JENSEN Dealer.

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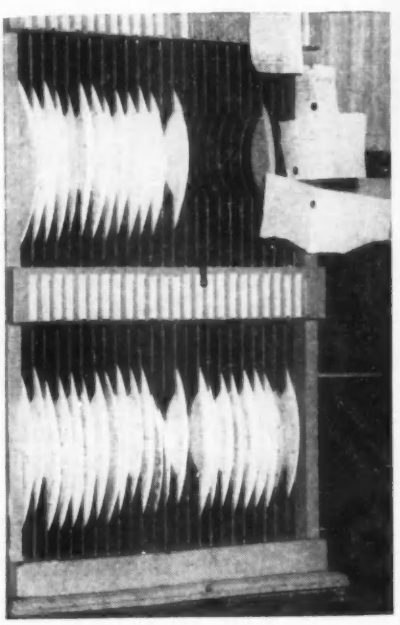


File Keeps Charts Available for Use

Used in an East Texas gasoline plant, the instrument recorder chart file illustrated is the answer to the problem of having the right chart readily available at all times. Each chart slot is provided with an identification tab to insure proper cataloging.

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Photo courtesy Imperial Oil Limited

THE THUNDERING WATERS of Alexandra Falls, dropping 106 feet in this section of the Hay River, 30 miles south of Great Slave Lake, sound a warning to three Imperial Oil Limited geologists who turn their canoe into the river bank.

Cautious Optimism Prevails in Canada

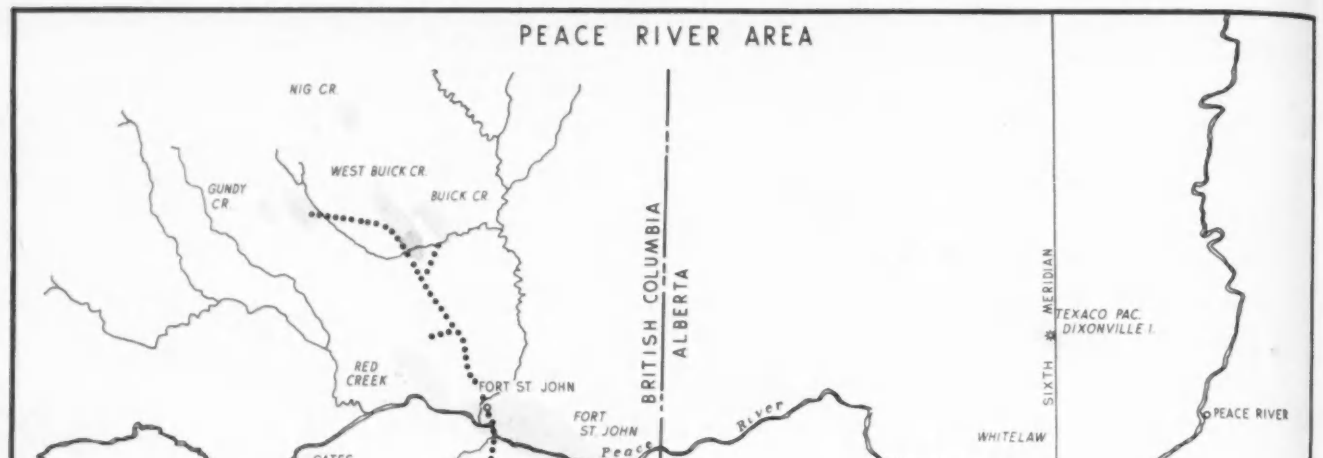
Gas line to eastern markets brightens outlook in the west as restricted crude outlets check all-out development.

By GILBERT WILSON, World Oil Staff

The problem of how their rapidly expanding potential crude production could be fitted into world markets occupied the thinking of most Western Canada producers during 1954. A problem that was starting to be felt in 1953, it was having a serious effect on the economic health of producers faced with gradually lowering allowables caused by:

- Mounting volumes of new crude coming on to market as new fields were discovered and developed.
- Competition of foreign crude, principally from the Middle East, which, due to low tanker rates, could be laid down in U. S. and other likely markets at prices below those for which Canadian crude could be delivered.

This was particularly the case with the U. S. West Coast, an area that Canada had long believed would be the logical outlet for crude trans-



Proposed Gas Pipe Lines to Provide Outlets for Canadian Production

ported to the coast through the recently-completed Trans Mountain crude line.

Underneath any disappointment or gloom that might exist, however, there prevailed an underlying note of cautious optimism sparked by several developments.

1. Rapidly increasing domestic demand: Western Canada this year, for the first time, was supplying approximately half of Canadian demand.

2. Another was the expected increase in demand in the Pacific Northwest area where, with completion this fall of General Petroleum Corporation's 35,000 barrel-a-day Ferndale, Washington refinery, and completion next year of Shell Oil Company's 50,000 barrel-a-day refinery at Anacortes, Wash., a substantial part of those crude needs would be supplied by Canadian crude.

3. Signs that Canada's oil industry was stabilizing; was settling down for perhaps a slower but nonetheless steady growth period that has characterized the oil industry elsewhere. It was realized, also, that in only the few years since the Leduc discovery in 1947, Western Canada could count some 6000 wells, as against only about 400 before Leduc; had a potential production of 375,000 barrels per day and was still climbing, as against only 19,000 formerly; could point to proven reserves of more than 2 billion barrels as against only 45 million barrels; and, with completion of facilities this year, and early next, could see a vast network of crude and products lines, and a greatly expanded and modern refining industry.

New discoveries, only one of which is the potentially huge Pembina field, point toward even further expansion of the industry as market outlets do appear to absorb the new production.

4. Expectation that a long-sought market for natural gas shortly would materialize with the building of the Trans-Canada gas transmission line that would take Western Canada gas to central and eastern markets, as well as to north central U. S. areas.

A market for gas almost certainly would be expected to result in a stepup in exploratory and development work; would augment the narrowing income of many producers. Although Westcoast Transmission Company's bid to transport gas into U. S. Pacific Northwest was turned down by the Federal Power Commission, there still were indications and rumors to the effect that some way ultimately would be found to place Peace River area gas into either the U. S. Pacific Northwest states, or possibly even as far south as California. Still to be heard from, also, is Westcoast's appeal to the FPC for a rehearing on its application.

According to Bureau of Statistics figures, Canada's production for the first six months was 42,232,615 bar-

rels, as compared with 33,391,423 barrels produced up to that time a year earlier. Natural gas production also was up, amounting to 65.1 billion cubic feet as compared with 52.3 for the first six months of 1953.

During the first nine months of 1954, Western Canada exploratory and development wells drilled reflected a 6 percent decline from the 1615 wells that had been drilled up to that same period last year.

New Cardium step-outs expand Pembina picture. By far the most significant development in Alberta was the Pembina discovery located some 75 miles southwest of Edmonton. This potentially huge field, which, with fewer than 100 producing wells completed, already seems assured of having between 300 and 400 wells producing from the Cardium sand, principal productive interval thus far established. The discovery well, drilled by the team of Socony-Vacuum Oil Company of Canada, Ltd., Seaboard Oil Company, Honolulu Oil Corporation, Merrill Petroleums Limited and Cancoll Oil & Gas Ltd., was completed in June, 1953, for 450 barrels per day of 37-gravity oil from a 41-foot interval in the Cardium sand of Cretaceous age topped at 5310 feet.

Completion of this well set off a chain reaction which, in little more than a year, has seen the establishment of a billion barrels of proven and semi-proven reserves in the Pembina sector. And this is but the start of what some authorities feel may be one of the largest, if not the largest, field on the continent.

Other zones already have been found productive within known productive areas of the main Pembina sector. These include: Basal Quartz at 6522 feet; Mississippian limestone at 6587 feet; Viking sand at 5880 feet. Gravity of the crude in these new zones ranged between 35 and 38 degrees.

Lending additional fuel to the fire of speculation as to the probable areal extent of the Cardium are these other widely scattered Cardium discoveries: At Peers, about 40 miles northwest of the main Pembina sector, a sub-commercial Cardium production well has been completed at 4900 feet; at Rocky Mountain House, 35 miles south of the main Pembina area, two commercial wells have been completed in the Cardium found at 6185 feet; at Garrington, 50 miles farther south, about midway between Calgary and Pembina's main sector, 41-gravity crude was obtained from the Cardium topped at around 6900 feet.

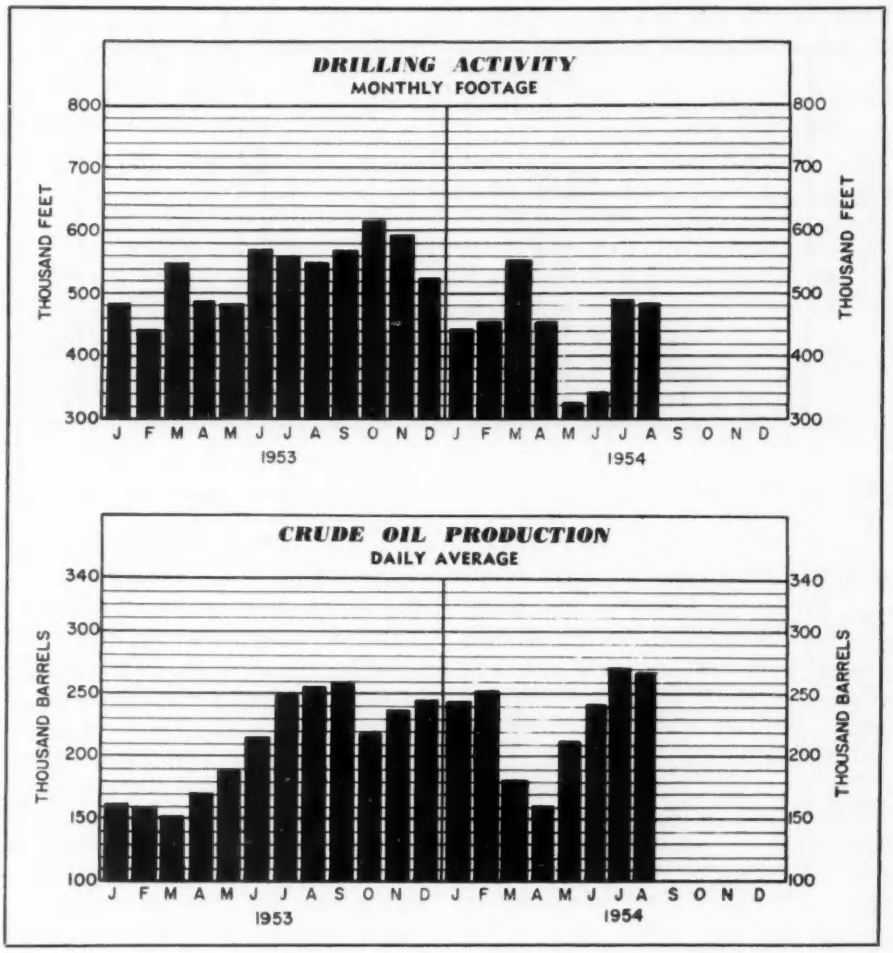


Chart courtesy Alberta Petroleum & Natural Gas Conservation Board, Calgary

Fig. 1—Alberta crude production reaches new highs, as revealed by lower chart. At the same time, however, drilling reflects a slump, due largely to unseasonably wet summer and fall which caused many rigs to shut down, especially in Pembina area.

Development and exploratory work at Pembina has been severely curtailed by an extraordinarily wet summer and fall. Those wells which were completed could not give a good accounting of themselves due to inability of operators to move the crude. Trucking so far has been the only outlet, but with the anticipated completion in November of the Pembina pipe line, it was expected that output would be stepped up appreciably. The October maximum allowable established by The Alberta Petroleum and Natural Gas Conservation Board has been set at 200 barrels a well per day.

Sturgeon Lake reef play expanding. Although the Alberta government in the early part of 1954 refused a permit to construct a crude oil pipe line to take Sturgeon Lake crude to market, there was mounting evidence that this 1952 discovery, 200 miles northwest of Edmonton and 75 miles south of Peace River town, was fast shaping up as a major high gravity producing area and soon would need a pipe line outlet. Now comprising two areas, labelled North and South, and extending in a northwest-southeast trend for approximately 25 miles, this important field, produces 35-gravity crude from Devonian D3 reef formation at depths of around 8750 feet.

By September of this year on the basis of 80-acre spacing, about 640

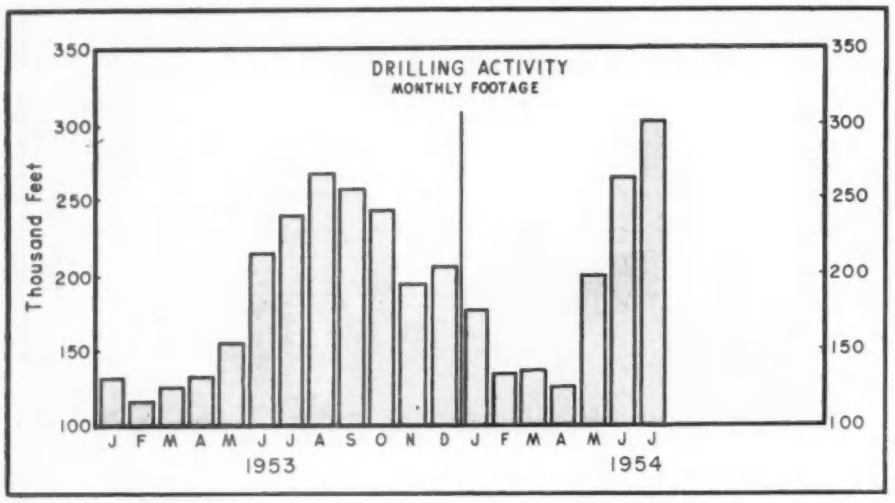


Fig. 2—Steadily increasing Saskatchewan production is revealed in chart at right. Chart at left shows graphically rapidly increasing drilling activity in the province. Slightly over half of footage was drilled on wildcat and outpost wells.

acres had been proven, but the fields were as yet undefined by the wells that have been completed thus far. Reserve estimates at this time are premature, but it is believed that indicated reserves may be in excess of 100 million barrels.

Pay zone thickness averages between 80 and 90 feet, but in at least one well in the South Sturgeon Lake sector 210 feet of oil saturated reef pay was found. Recently-completed wells in the South Sturgeon Lake area have exhibited some exceptionally high potentials.

One of these, Union Oil Company and Hudson's Bay Oil and Gas Company Liberal 5-33, was placed on production early in November and on a 6-hour flow test, produced at a rate of 1200 barrels per day of clean oil per day from Devonian reef from perforated interval 8604-8616 feet. This latest completion is 4½ miles west of the companies' Liberal 15-31, which earlier had been completed flowing at a 4500 barrels per day rate.

Further enhancing prospects for the area, Amerada Petroleum Corporation, discoverer of the Sturgeon Lake reef area, has reported the discovery, in two of its recent wells, of 3.2 Mmcf gas flow in the Basal Cretaceous and a 4.2 Mmcf flow of gas, along with some condensate, in a recent Triassic test.

Alberta footage down. Alberta's August production of 8,314,356 barrels (268,205 barrels daily), was down only 112,890 from July's all-time high of 8,427,246 barrels. Production during August of last year amounted to 7,958,820 barrels. Footage drilled (see Figure 1) in August of this year totaled 482,248 feet, down 2 percent from the previous month, and down 12 percent from the 548,620 feet drilled in August of last year. Cumulatively, also, footage drilled through August, 1954, 3,555,817 feet, was down almost 14 percent from the 4,121,284 feet that had been drilled up to the same time last year.

By the end of August, Alberta had 4328 operating wells out of a total of 4893 producible. This represented an increase of 669 producible wells since the like month last year.

Redwater field, with 902 producing wells out of a total of 924 producible, continued to be the top field insofar as production was concerned, turning out 82,000 barrels per day. Leduc-Woodbend was in second place, production-wise, with a daily output of 58,500 barrels, but from a greater number of wells, 1235 out of a total of 1278 producible.

Saskatchewan finding higher gravity oil. Saskatchewan continued to chalk up new discoveries during the year. Encouraging was a rapidly expanding trend of medium-to-high-gravity oil Mississippian lime discoveries, most of them in the Mission Canyon section which is taking shape in the southeastern corner of the province. Depths of the limestone pay in this area range from 400 to 4600 feet, and gravities range from around 27 to 31.

Among the new Mississippian lime fields discovered in 1954 are Frobisher, discovered in April and which in November had five producing wells; and Huntoon, discovered in January, and which also had five producers.

Moderate development drilling is continuing in these and other fields in the vicinity. Development work is continuing also, in the medium gravity fields in the Fosterton, Success and Cantuar sector where, with completion by mid-1955 of the 155-mile, 16-inch line connecting these fields with the Interprovincial pipe line at Regina, an outlet for between 15,000 and 20,000 barrels of oil per day is expected.

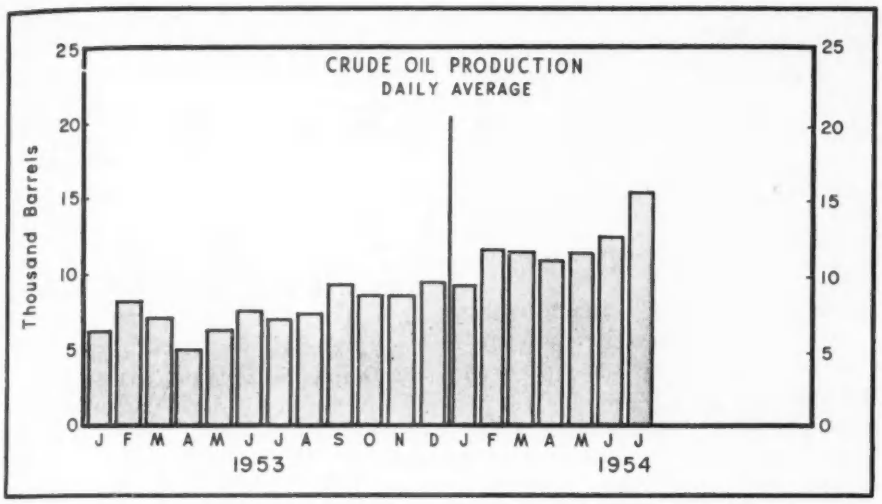
This medium gravity crude, for which a new refinery is being constructed in the Minneapolis-St. Paul area, will be taken off from the Interprovincial line at Clearbrook station, in Minnesota, and will continue on down by pipe line to the refinery.

The Smiley Field in west-central Saskatchewan, near the Saskatchewan-Alberta border has been pretty well drilled up. Constituting the first and, so far, the largest major light gravity (36°) crude reserve in Saskatchewan, this September 1953 discovery, now has 114 oil wells.

With production coming from the Viking sand at around 2300 feet, recoverable reserves of this field are estimated at about 100 million barrels. Production in Saskatchewan during 1954 was showing an extraordinary increase. Marking an all-time high, (see Figure 2) production during July amounted to 492,380 barrels, averaging 15,883 barrels per day, more than twice the 234,519 barrels (7565 barrels per day) produced in the like month of 1953.

Drilling activity (footage) reported for the month also showed an all-time high, amounting to 303,821 feet, slightly over half of which was in wildcat and outpost drilling. There were 620 wells producing during the month out of 909 producible. During the comparable month last year, the province had 414 wells producing out of a total of 657 producible.

In late fall of this year, 22 participating companies had 36 seismic, two gravity and magnetometer, six magnetometer, two geochemical soil survey, and five electromagnetic crews in the field in Saskatchewan.



Charts from Monthly Oil and Gas Report of Saskatchewan Department of Mineral Resources, Statistics Division.

Manitoba activity accelerated. Daly and Virden-Roselea areas of southwestern Manitoba continued to show a major growth. Three principal fields accounted for most of the activity—Daly, Virden-Roselea and North Virden-Roselea—the latter being a more recent (December, 1953) discovery.

Of 191 producing wells in Manitoba accounted for in August, 1954, 110 were in the Daly field, 39 in Virden-Roselea and 23 in North Virden-Roselea. The remaining 19 wells were in surrounding areas. Some idea of the rapid development that has taken place in the past year can be gained from the fact that only a year earlier, only about 56 wells, principally in the Daly field, were producing.

Comparatively easy drilling, shallow depths ranging from 2000 feet to slightly more than 3000 feet, high gravity oil, and a ready market for the crude combine to make this an attractive area for exploration and development. Production is mainly from the Lodgepole horizon of the Mississippian lime, with net pay thickness ranging from 20 to 55 feet. J. C. Sproule & Associates have estimated that proven, semi-proven and possible recoverable reserves of the three principal Daly and Virden fields at 53,760,912 barrels.

Future development of the some half-dozen other discoveries made during the past eight or nine months may see these production and reserve figures boosted appreciably.

By the end of 1954, it is believed, the area should be producing at a rate of about 7500 barrels per day. Illustrating the rapid rise in output in the province, production in August, 1954, amounted to just under 7300 barrels per day, as compared with 1820 barrels per day in 1953 and 184 barrels per day in 1952. Total producing wells in August, 1954, amounted to 191. During that month, 18 new wells were placed on production.

FPC decision slows B. C. activity. Drilling activity in British Columbia, through September 1954, although reflecting a sharp drop from that of the same period last year, nevertheless accounted for 102,817 feet of hole. This was a drop of about 35 percent from the more than 159,000 feet of hole that had been chalked up through September of last year. Most of the drilling was exploratory in nature, consisting mainly of extension tests and testing of seismic structures largely west and north of the Fort St. John field, the latter now rated as the largest gas field in Western Canada.

An average of from six to seven rigs were in operation during the several months up to the end of August, a drop to about half the number in operation during the same period last year.

Decision of the U. S. FPC to reject Westcoast Transmission's application for a permit to deliver Peace River area gas into the U. S. Pacific Northwest accounts for some of the decline in activity.

Continued brisk exploration work, particularly in northwestern British Columbia, however, indicates an underlying belief that ultimately an outlet for gas reserves in the area will be found. The huge Fort St. John field, whose exact limits on at least two sides still remain to be fully outlined, is but one of numerous structures currently being tested and/or developed in the Alberta-British Columbia Peace River area.

The Fort St. John field now has some two dozen widely spaced wells, some of which have open flow potentials in excess of 20 Mmcf a day. The field so far is known to have at least nine productive zones. One field well completed in July by Pacific Petroleums, Ltd., on open flow potential, flowed from the Permo-Penn formation at 6700 feet at the rate of 71 Mmcf daily. At that time company officials pronounced it by far the largest well ever completed in the Peace River area and possibly greater than anything else in Canada. The well penetrated eight separate gas zones in going to total depth of 12,955 feet.

Pacific Petroleums, largest operator in the area, has indicated that numerous other likely structures in northeastern British Columbia area, 29 on properties of their company alone, have been found by geophysical work.

In Red Creek structure, about 15 miles northwest of Fort St. John field, three productive gas zones have been discovered and follow-up work is continuing. Encouragement has been found also in the Gates Anticline, 40 miles west of Fort St. John. Hopes are held for other structures.

In June, the Pacific Petroleums group announced what may be the first discovery of oil in commercial quantities in British Columbia. The group's third venture in the Buick Creek field, 45 miles northwest of Fort St. John, found 28 feet of oil saturated section in the Nikinassin section of the Jurrasic. A 39-foot gas cap overlaid the oil section.

In the same region, gas in two zones was found in another exploratory well, and gas in three zones was discovered in yet another.

Exploration brisk in NWT. Exploration work is continuing at a brisk pace in the Northwest Territories and Yukon Territory area of northern Canada. During the past summer, a

record amount of geological work and surface mapping was done in the vast Mackenzie River Basin.

Although the region presents many difficulties in transportation and problems resulting from the remoteness of sources of supply, there exists a strong appeal to oil exploration since an estimated 200,000 square miles of the Basin is known to be underlain by sedimentary rocks considered favorable for the presence of oil.

Tantalizing, also, is the fact that high gravity Devonian Reef oil is being produced at Norman Wells field, situated in the Basin at a point just below the Arctic Circle, a thousand miles northwest of the Devonian Reef fields near Edmonton.

Increasing use of helicopters, as well as conventional aircraft, has been instrumental in the past year or so in expediting exploration work in the region. With such equipment, it now is possible to conduct exploration work more quickly, and at about half the cost.

During the 1954 working season, five mapping programs were under way in the Mackenzie River Basin, including 19 field parties.

Coast-to-coast pipe line system completed. Principal crude oil pipe line activity in 1954 included:

- Extensive looping of about 450 miles of Interprovincial's crude line system.
- Construction work on South Saskatchewan Pipe Line Company's 155-mile, 16-inch crude line providing an outlet for the medium gravity crudes of the Fosterton-Cantuar-Success area of southwestern Saskatchewan.
- Start of work on Pembina Pipe Line Company's 72-mile, 16-inch Pembina-to-Edmonton crude line.

The new throughput of the Interprovincial line after completion of looping work, will be approximately 205,000 barrels a day out of Edmonton; 170,000 out of Regina; 159,000 out of Gretna, on the Manitoba border; and 138,000 out of Superior, Wisc.

Coupled with the recently completed eastern additions to the system, and in particular the crossing at Mackinac Straits, and connecting of Superior by pipe line with Sarnia, the Interprovincial system now is in a position where eastern Canadian crude demand can more nearly be matched by Western Canada production. The two major crude pipe lines, Interprovincial, 1765 miles long, and Trans-Mountain, 720 miles long, now constitute an east-west 2485-mile crude pipe line system of major proportions having a daily capacity in excess of 300,000 barrels per day.

Trans-Canada line plans jell. Early in 1954 the problem of how and when eastern markets would be opened up for Western Canada gas finally was resolved. Trans-Canada Pipe Lines, Ltd., formed by the merger of two companies that formerly had been competing for the right to build the line, was organized and plans were started immediately for building a 36-inch gas transmission line from a point on the Alberta-Saskatchewan border eastward to Winnipeg. From there a 24-inch lateral will extend southward into Minnesota and a 30-inch line would continue eastward from Winnipeg to eastern Canada cities. The main east-west transmission line would be about 2200 miles in length.

Alberta gas would be picked up through an extensive gathering system to be known as Alberta Gas Trunk Lines Company, Ltd., which would be under the control of the Alberta provincial government. As presently contemplated, this gathering system will be 318 miles long. Pipe sizes would range from 18 to 36 inches.

Currently, Trans-Canada has signed a 25-year contract to sell gas to Northern Natural Gas Company of Omaha for delivery to the Minneapolis area, although approval of the U. S. FPC yet must be obtained. Problems relating to financing of the $300 million line and signing up of contracts along the route of the main Trans-Canada line still are being worked out. Under present plans, however, it is anticipated gas will be flowing into Winnipeg by the fall of 1955 and, by late 1956, into Toronto and possibly Montreal.

In the opinion of N. E. Tanner, Trans-Canada's president, Western Canada will witness greatly accelerated exploration, drilling and development programs as soon as the eastern market for gas is opened up to Western Canada producers.

Gas reserves in Alberta alone, it is estimated, amount to more than 13.4 trillion cubic feet, about 2 trillion feet higher than the 1953 figure. Alberta reserves should increase, it is estimated, at a rate of about 1.3 trillion cubic feet annually. The Trans-Canada permit allows the removal of 4.35 trillion cubic feet of gas over a 27-year period.

Almost half of rigs on wildcats. In early October, according to a survey of drilling contractors conducted by *Daily Oil Bulletin*, Calgary, 181 rigs were at work in Alberta, Saskatchewan, Manitoba, British Columbia and Northwest Territories. Unseasonably wet weather played a large part in reduced drilling activity during the summer and early fall months of 1954.

It is significant to note that roughly 45 percent of all the rigs operating were on wildcat locations. Alberta, with 122 rigs, had 76 on development work and 46 on wildcats; Saskatchewan, with 35 rigs, had 12 on development and 23 on wildcats; Manitoba with 20, had 12 on development and eight on wildcats, and British Columbia had four rigs, all on wildcat work. No rigs were operating in Northwest Territories at that time.

Alberta's picture will change this winter, however, with the anticipated increase in development work that will resume at Pembina, as well as other areas where wet ground had slowed activity, as soon as cold weather makes roads passable. Complete shutdown of many of the Pembina rigs during the summer resulted in a sizable back-log of work which, it is believed, will be worked off this winter.

Refining capacity expanded. Refining capacity in Canada, since the discovery at Leduc in 1947, has grown at a rapid rate and, by the end of this year will reach approximately 600,000 barrels daily. Refining capacity in Alberta, for example, has been tripled in that time.

Saskatchewan and Manitoba refining capacity by year-end will be about 96,000 barrels daily, up some 24,000 barrels from the capacity existing in 1953. British Columbia will have a capacity of some 53,000 barrels per day. —**The End**

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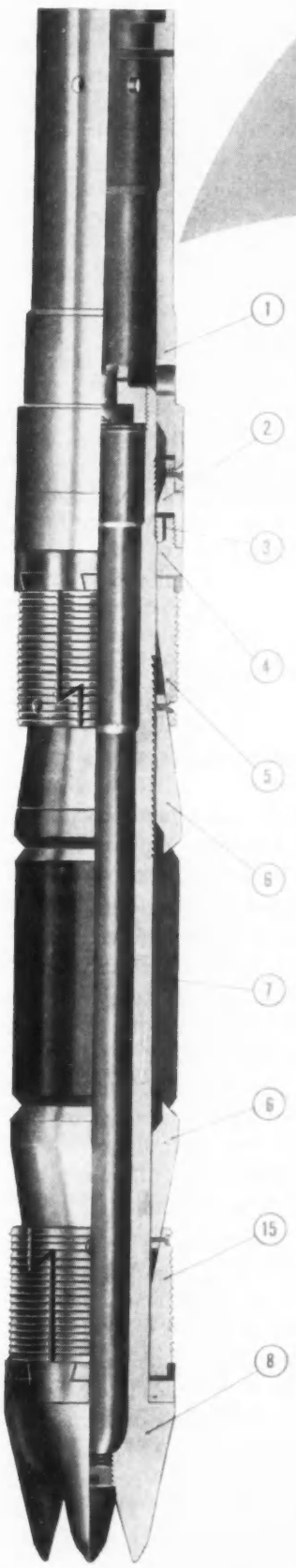

and see how and why it gives such positive packoff against pressures either up or down

1. Ram Adapter, to transmit downward pressure of setting tool. It may be removed after the plug is set.
2. Lock Ring Adapter forms a housing to enclose the lock ring and prevent its movement after engagement with the body.
3. Lock Ring, triple-wickered, engages wickers on the body to prevent any unsetting action after packoff. Both lock ring and seat are tapered so that, the greater the external pressures, the tighter the locking action.
4. Slip Locking Ring acts as a guide for the slips, which are dovetailed into it, insuring even movement and equal pressure against the casing on all sides.
5. Upper Slips support the body against pressures from below and prevent upward movement of the set plug.
6. Cone. The two cones force the slips against the casing and expand the packing sleeve for leak-proof packoff.
7. Packing Sleeve of oil-and-gas-resistant synthetic rubber is double-lipped, with a wire in each lip, to insure positive packoff and fast running without premature expansion. The greater the differential pressures, the tighter the seal.

15. Lower Slips, keyed to the body, prevent downward movement of the set plug from upper hole pressures.

8. Body. The foundation of the plug. In drilling out, the body drops to bottom after the lock ring grip is broken. The bull plug fins, tapered to guide the plug into liners or other restricted passages, prevent rotation under the bit when the entire plug is to be drilled up.

If you don't have your copy of the new, revised Lane-Wells Bridging Plug Bulletin, write for it now. It gives full details on construction, applications and drillout procedures.

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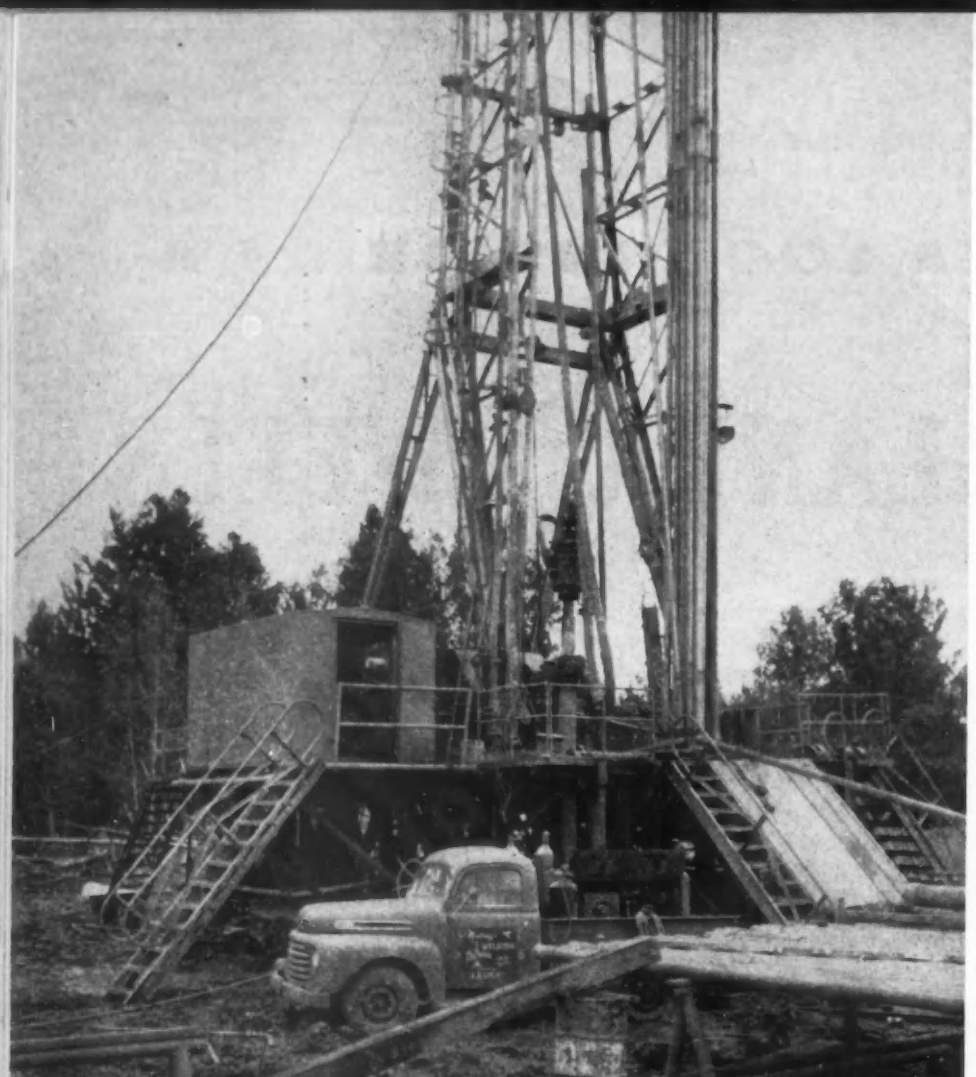


SOGGY TERRAIN caused by heavy rainfall during 1954 makes it a major effort to get a light welder's truck up to the floor of a typical Pembina field drilling well.

Pembina Field's Development Drilling Proves Successful

Three Cardium and one Mississippian oil producers result from four wildcats drilled by Stanolind Oil & Gas Company in three directions from Cardium sand area.

A WILDCAT in virgin territory of westcentral Alberta during March of 1953 gave up a pipe recovery of only 110 feet of heavily oil and gas-cut mud during drillstem test in a 41-foot interval down to 5376 feet, and was classed as an interesting oil showing. However, as a result of this lonely wildcat's oil showing, about 80 prolific oil wells already have been completed in that district. And engineers estimate that the region may result in the largest major oil area so far discovered in Canada.

This key wildcat was drilled in the now noted Pembina region, about 65 miles southwest of Edmonton and 45 miles west of the prolific Wizard Lake oilfield, which is a part of the Devonian reef area that extends south of Leduc, on the "reef fairway."

The first formation to yield oil discovery at Pembina was the Cardium sand and horizon. Since that first well was drilled, oil has also been found in indicated commercial volume in the Mississippian, Viking, Basal Quartz, and Belly River sand.

Oil production at Pembina is contained in a vast region that stretches in a northwest-southeast direction for about 70 miles, with the most remote east-west producers being about 25 miles apart. However, it would be stretching the imagination to its utmost to believe that the whole region is commercially productive, and at this stage extensive drilling is still necessary in order to prove outlying discoveries and rate it as Canada's largest crude reserve. The major portion and concentration of development drilling has so far been carried out in six of the townships in the central portion of the region. Estimates of crude reserves in the entire area have ranged up to a billion barrels, but that figure could be sliced considerably following an extensive drilling program.

The discovery well at Pembina was drilled by the American-Canadian Team of Seaboard Oil Company, the Honolulu Oil Corporation, Merrill Petroleums Ltd., and Cancoll Oil & Gas Ltd., the latter being the oil-operating unit of Canadian Collieries (Dunsmuir) Ltd., on farmout lands from Socony-Vacuum Oil Company of Canada Ltd. That group, the major operators and also major acreage hold-

THICK, SOUPY MUD characterizes this view of one of the main streets of Drayton Valley, bustling boom town in the heart of the Pembina field.

ers in the region, share the discovery well and a tremendous spread of Crown lands in the area on the following basis: Socony, 50 percent; Seaboard and Honolulu, each 16⅔ percent; Merrill, 10 percent; and Cancoll, 6⅔ percent.

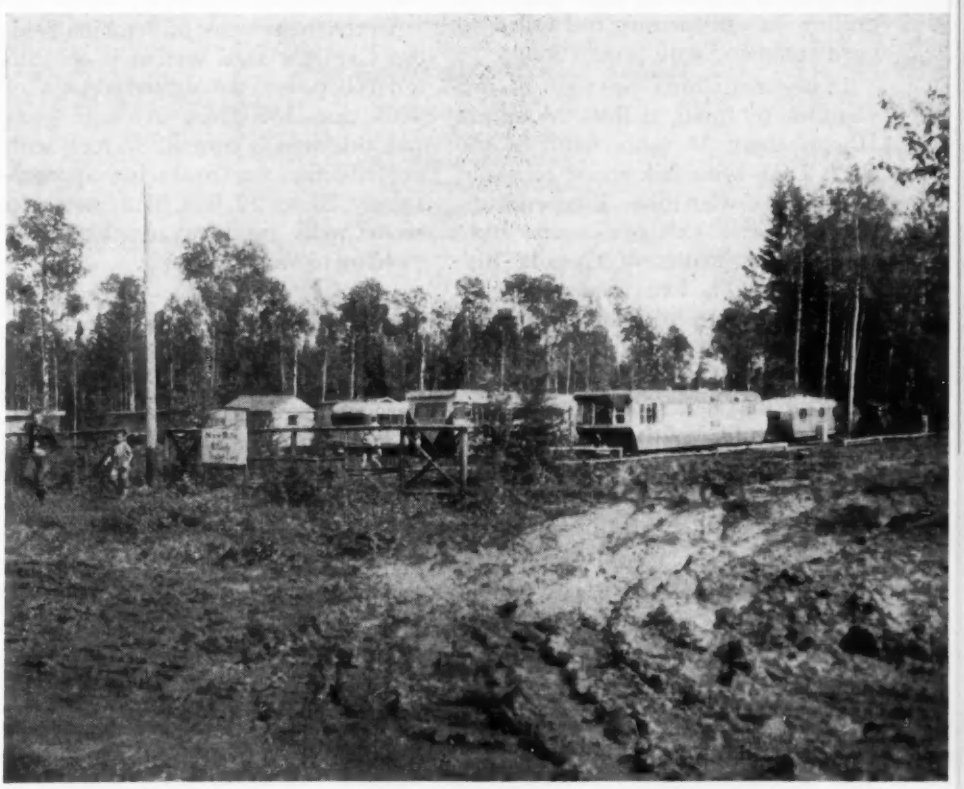
The discovery well, Socony-Seaboard-Pembina 1, lsd 4-16-48-8w5, now in the approximate center of the main development sector of the proven area, was 15 miles northwest of the nearest previously drilled well, the Canadian Delhi-et al-Minnehik 1 Madison (Mississippian) limestone wet gas discovery well. The well, after finding only what was believed to be an interesting oil showing in the Cardium sand, was taken down to total depth of 9425 feet and then plugged back preliminary to testing that Cardium showing.

The Cardium sand was topped at 5310 feet, or 2277 feet subsea, and 7-inch production casing was set at 5422 feet. Hole was perforated from 5399-48 feet and 5348-57 feet with 4 shots per foot. When swabbed, the well commenced flowing 37 gravity crude at a rate of 5½ barrels hourly. After applying a wash treatment, the well flowed at a rate of 19 barrels hourly or 456 barrels daily, through a ⅜-inch choke. Gas-oil ratio was 435 cubic feet per barrel. A discovery of extreme significance was assured, and a 6¼ mile northeast stepout to that discovery then was announced.

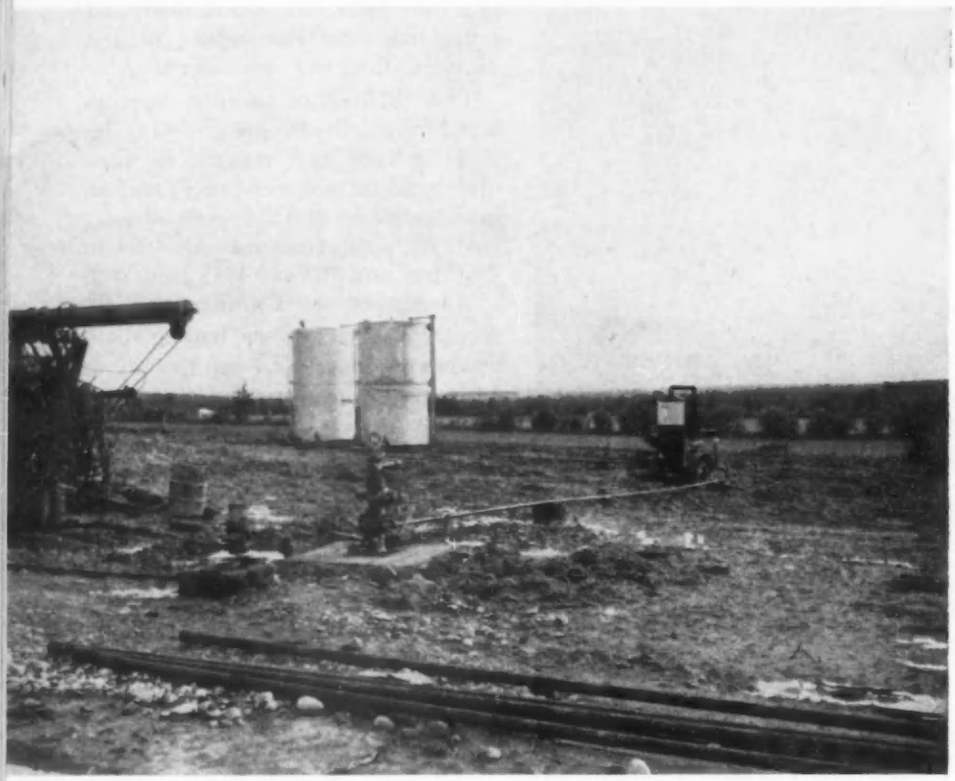
This follow-up venture, Socony-Seaboard-North Pembina 11-13, lsd 13-11-49-8w5, also resulted in Cardium sand oil discovery, and rated an initial potential of 612 barrels oil daily from the perforated intervals 4994 to 4979 feet and 4970 to 4947 feet. Well 11-13 entered the Cardium at 4946 feet, or 2001 feet subsea, finding about 60 feet of developed sand, with at least 36 feet of good oil pay zone.

Successful stepouts. A continuous stepout drilling program was followed by the Socony-Seaboard group, and oil success was almost invariably the case. Stanolind Oil & Gas Company drilled four wildcats to the west, southwest and northwest of the Cardium oil area, with three Cardium oil wells and one Mississippian oil success resulting. Those wells were drilled on lands acquired under agreement from Hudson's Bay Oil & Gas Company Ltd.

Shell Oil Company discovered oil in the Cardium at its Peers Strat Test 2 well, about 40 miles northwest of



TRAILER CAMP. Hacked out of thick poplar and birch-forested area, this trailer camp site is home for many families of personnel connected with drilling companies, service and supply firms. On the outskirts of Drayton Valley town, this camp is mired in the mud resulting from 1954 summer rainfall.



THIS PEMBINA FLOWING WELL was recently placed on production. Temporary tanks and portable trap and meter unit are in the background.

the first Cardium oil discovery well at Pembina. That well appears to be a marginal producer, and follow-up drilling in the vicinity has failed to yield commercial oil production.

In the southern portion of this Cardium oil trend, at Rock Mountain House, about 18 miles south of the Buck Lake-Minnehik sector oil wells, a group of Canadian independents, New Superior Oils of Canada Ltd., General Petroleums of Canada Ltd. and Altex Oils Ltd., has discovered Cardium oil. In addition to the discovery well, the first follow-up, a three-eights mile offset, has been assured of oil success, and a third venture (one mile south) now is underway, and site has been staked for a fourth well.

In still another major stepout, in the Garrington area, approximately 50 miles southeast of the Rocky Mountain House Oil strike, New Superior Oils of Canada, General Petroleums and Altex, on farmout lands from Anglo-Canadian Oil Co. Ltd., the Calgary & Edmonton Corporation Ltd., and Security Freehold Petroleums Ltd., discovered Cardium sand oil production. This venture entered the Cardium at 6805 feet, or 3170 feet subsea. During a short production test, this well produced oil at a rate of 100 barrels daily.

In the main sector of Pembina field, the Cardium sand section is encountered between the drilled depths of 4600 and 5400 feet. Average gross pay thickness is around 32 feet, with net effective pay averaging approximately 20 to 24 feet, with northern sector wells (at Drayton Valley), yielding as low as 8 feet.

Cardium has two zones. There are two sand zones in the Cardium in most sectors of the Pembina field, with varying characteristics across the field as it approaches the pinchout and, in places, there are three zones.

In most completions the production string of casing is set through the Cardium to total depth. Procedure is generally to perforate and sand-frac opposite the poorer permeability section of the Cardium to get the oil out of that zone, and open up the better zones at a later date.

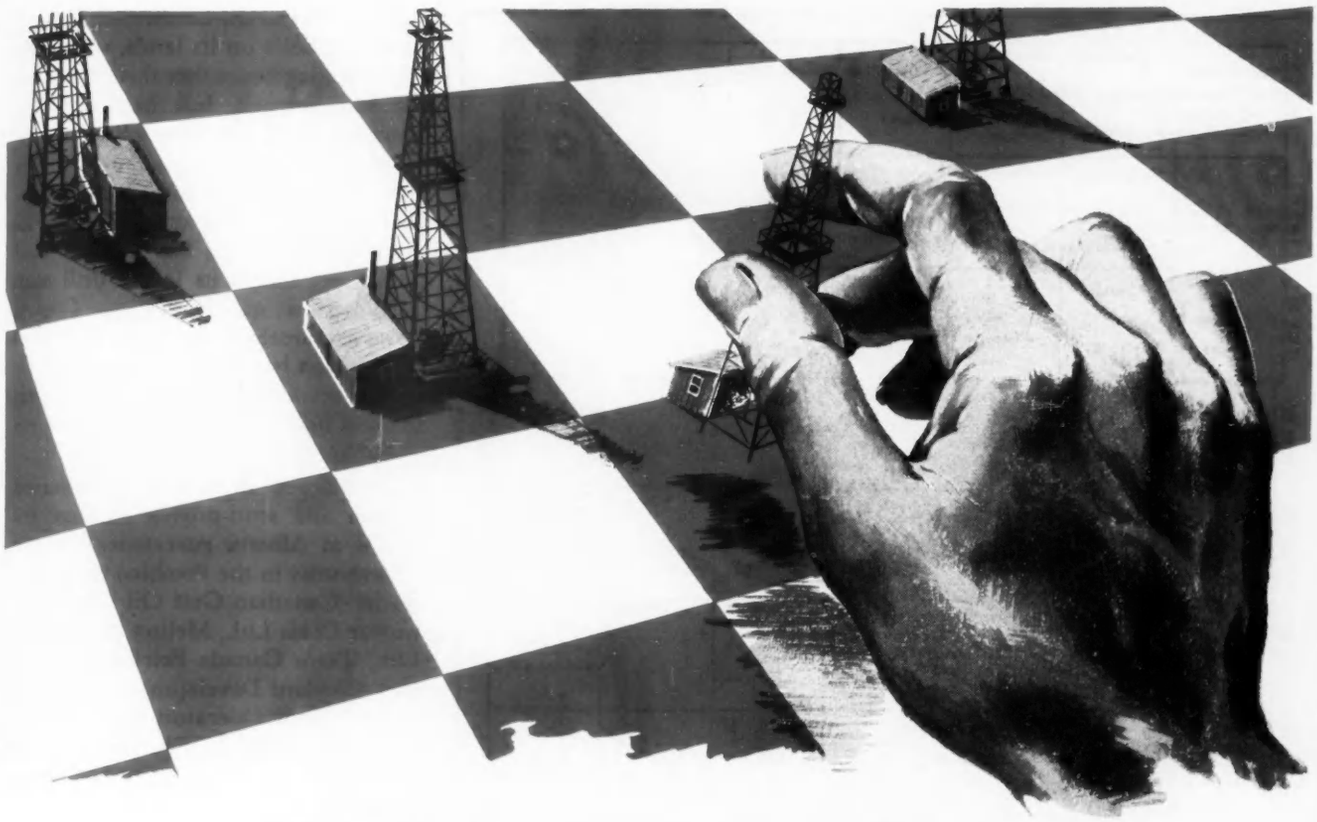
Reserve estimates are placed at around 300,000 barrels gross per acre, with current proven and probable reserves estimated at 750 million barrels.

The Alberta Petroleum and Natural Gas Conservation Board set the Pembina Cardium oil well allowable production rate at 114 barrels daily per well for September, with the field allowable for that month of 4560 barrels daily. However, due to extremely wet weather, transportation conditions in the Pembina field were such that it was not possible to transport oil from many well sites to the oil purchaser's receiving stations for some time. Allocation to the Pembina field for September, although normally 4560 barrels daily, was adjusted to 2000 barrels a day actual, with the individual well allowable calculated on the basis of the high daily pool allowable of 4560 barrels.

Well spacing at Pembina is on the basis of one well to the Cardium formation to each 80-acre tract. The crude oil price for Pembina oil was $2.76½ per barrel f.o.b. Gainford a point along the Trans Mountain oil pipe line.

Pipe line being built. All crude was being marketed from Pembina wells by truck. But by mid-November of this year the Pembina Pipe Line Company Limited was scheduled to have its 72-mile 16-inch diameter transmission line completed into Edmonton. That $15 million pipe line project was to have an ultimate carrying capacity of 125,000 barrels daily, and may be raised to 150,000 barrels daily with the addition of a booster station. The main pump station is about 35 miles south of Gainford and the main line runs in an east and northeast direction through the Leduc oil field and on into Edmonton. Initial throughput of the line this fall was to be from 10,000 to 15,000 barrels daily.

Adverse weather conditions this year also have curtailed drilling activity in the region. Major operators with projected large programs and even companies with only a few well sites planned for this year will not possibly be able to reach their projected program. Some major firms will be short some 30 to 40 well completions that originally were planned to be drilled prior to year-end. Road conditions in the region are such that only extremely dry weather or frost will permit normal transportation. Since summer months chalked up a near record heavy precipitation in almost all areas of the province, Pembina activity was



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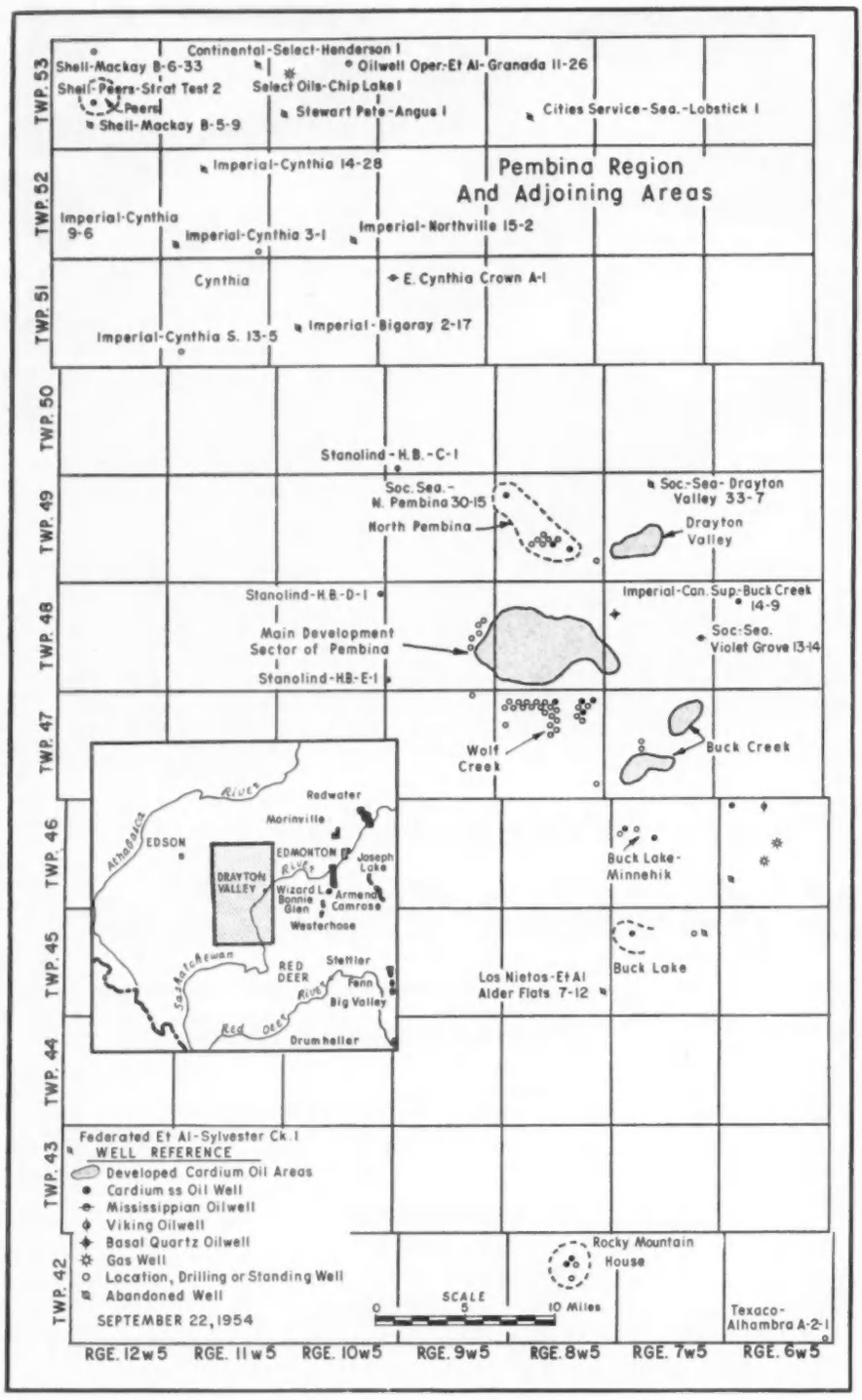

not expected to get into full swing until a heavy frost made roads solid enough for heavy transportation.

Pembina has proved a bonanza for the Alberta government treasury, as it disposes of reservation and lease areas within the proven, semi-proven and exploratory sectors of the huge region.

Texaco Exploration Company paid out a cash bonus of $13,000,125 for exploration reservation rights underlying 92,160 acres of exploratory lands on the Cynthia reserve (Twps, 49 & 50 Rges. 10 & 11 w5), offsetting Stanolind-Hudson's Bay drilled oil wells to the west. Imperial paid a bonus of $11,087,533 for right to explore a 92,160-acre Cynthia reserve tract (Twps, 51 & 52 Rges. 10 & 11 w5), immediately north of Texaco lands.

Both companies will be permitted to take out lease lands on 50 percent of that reservation acreage if they desire. Imperial Oil Limited has drilled three dry holes on its lands, was drilling or testing at another three wildcats on that acreage, but had not announced their outcome. The lands were purchased in January of this year. Both Imperial and Texaco carried out extensive geophysical operations on the lands, but Texaco had not as yet staked its initial drill site.

Numerous quarter-section Crown Reserve parcels in the proven region of Pembina have already been sold by the Alberta government, and cash bonuses paid have ranged up in excess of $525,000 per 160-acre tract.

Companies that have purchased proven and semi-proven acreage interests at Alberta government crown reserve sales in the Pembina region include: Canadian Gulf Oil Company, Luscar Coals Ltd., Melton Petroleums Ltd., Trans Canada Petroleums Ltd., New Concord Development Company Ltd., Oilwell Operators Ltd. (Home Oil Company Ltd., Federated Petroleums Ltd., and Alminex Ltd.), Dome Exploration (Western) Ltd., Dome Canadian Petroleums Ltd., Compagnie Francaise des Petroles, Canadian Bishop Oil Ltd., Canadian Fina Oil Ltd., Seaboard Oil Company, Mountain Park Coals Ltd., McColl-Frontenac Oil Company Ltd., Scurry Oils Ltd., and Rainbow Oil Ltd.

Other substantial acreage holders in the area in addition to the discovery team include: Stanolind Oil & Gas Company, Hudson's Bay Oil & Gas Company Ltd., Great Plains Development Company of Canada Ltd. (Canadian Petrofina Ltd. which recently acquired an interest in a portion of the Great Plains lands under a development agreement), and Bailey Selburn Oil & Gas Ltd. Central Leduc Oils Ltd., and Del Rio Producers Ltd., Calgary independents, also hold an interest in some lands that were farmed out to Stanolind.

There are two towns in the Pembina region that have started to boom as a result of the activity in the area—Drayton Valley and Buck Creek. The newest "boom" town is Buck Creek, which is situated on the south end of Pembina field, south of the North Saskatchewan river, 20 miles west of Edson and about 60 miles southwest of Edmonton. A modern cafe has been completed at Buck Creek, and the new town is fast developing as a service-supply and pipe line center.

—**The End**

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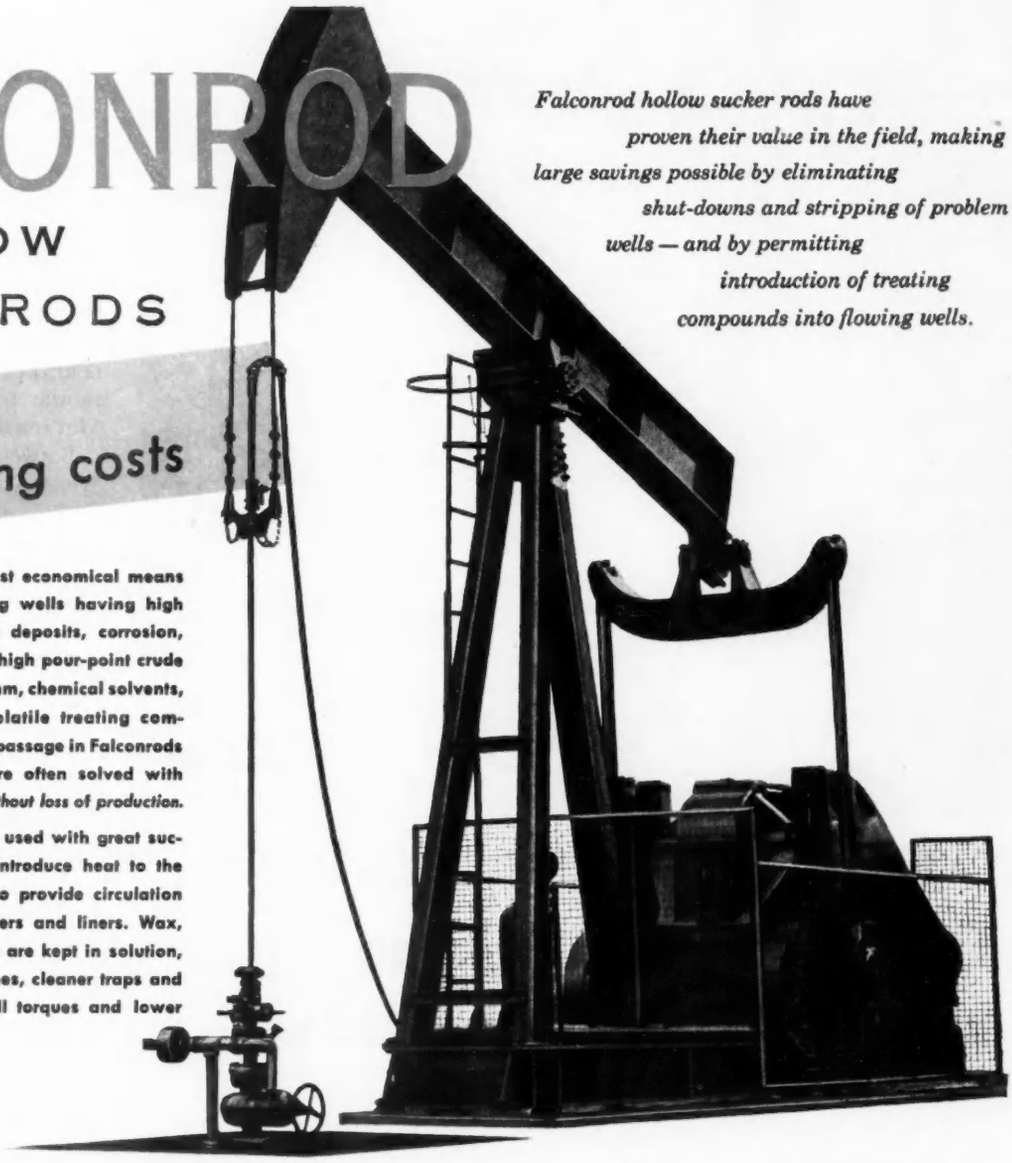

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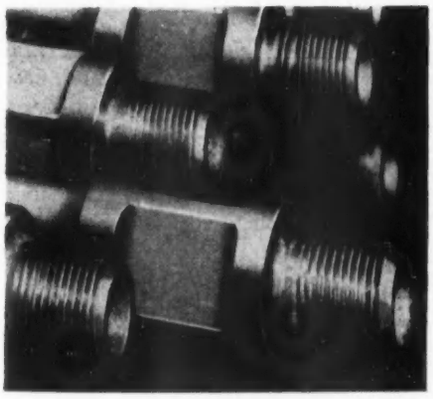

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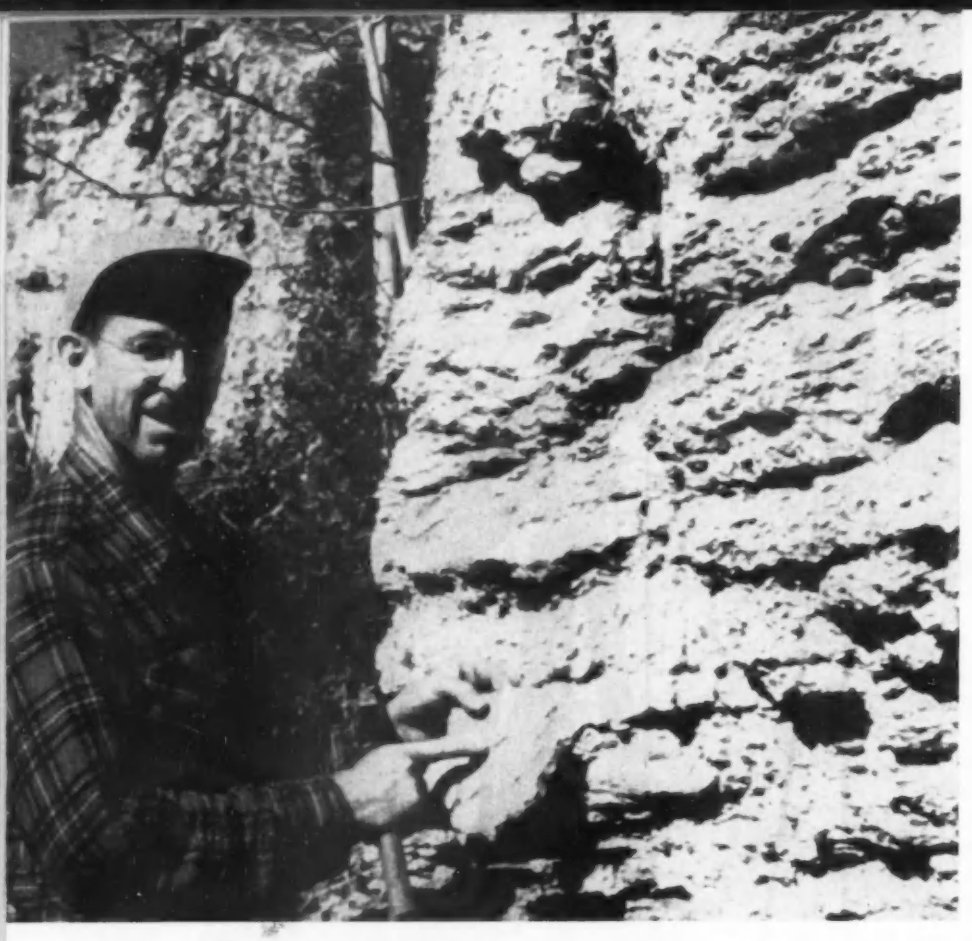

OUTCROP OF UPPER DEVONIAN REEF in the Hay River area of Northwest Territories is examined by Dr. J. C. Sproule, consulting geologist, Calgary, Alberta.

Exploration Is Picking Up In Mackenzie River Basin

Air photographs and aircraft help geological reconnaissance parties overcome major obstacles.

By DR. ARTHUR B. IRWIN
Petroleum Observation Engineer for Northwest and Yukon Territories, Department of Northern Affairs and National Resources

A RECORD geological surface mapping program was conducted last summer in the Mackenzie sedimentary basin north of 60° north latitude —one of the most promising regions for oil discovery in the western hemisphere. Extensive use has been made of helicopters and conventional aircraft has resulted in a much greater coverage per man than possible had travel been restricted to water and land methods. Consequently, the cost of mapping a given area has been reduced.

The Mackenzie River basin, with an area of 680,000 square miles, includes the northern parts of British Columbia, Alberta, Saskatchewan, the western part of the Northwest Territories and the northeastern and southeastern parts of the Yukon Territory. It is exceeded in area on the North American continent only by the Mississippi drainage basin. The Mackenzie Basin includes three physiographic provinces: on the west, the Cordilleran region; on the east, the Precambrian shield; centrally, the northernmost extension of the Great Central plain of North America. More than 200,000 square miles of this basin lying within the boundaries of the Northwest Territories and Yukon Territory (hereinafter referred to as the Territories) is underlain by a sedimentary rock series favorable for oil discoveries. It includes all the northern part of the Great Central plain and a small part of the Cordilleran region. (see map)

Prior to 1920, only a few reconnaissance surveys had been made in the Territories by officers of the Geological Survey of Canada, all by canoe.

As a result of the discovery of oil near Fort Norman in 1920, interest in the petroleum possibilities of the Mackenzie basin was stimulated.

Between 1920 and 1941, Norman Wells field was partially developed by four wells. Production from these was sufficient to fill requirements of the local market in the Northwest Territories. Due to the commercial market and the failure of wildcat wells to find oil elsewhere in the Fort Norman area and in the Great Slave Lake area, interest in the region declined over a period of years.

Due to wartime necessity, the Canol Project was started in 1942 to fully develop Norman Wells field, to search for new sources of oil and to transport the oil by pipe line to Whitehorse, Yukon Territory, for refining and distribution. Exploratory programs under the Canol Project from 1942 to 1945 included geological mapping, geophysical mapping and drilling. The geological mapping was carried out during 1942 and 1943 under the direction of T. A. Link of Imperial Oil, Limited. Thirty seven reports by 13 authors are noted as resulting from these efforts.[2]

Interest renewed. After the finish of the Canol Project in 1945, interest in exploring for oil and gas in the Mackenzie Basin again lapsed, although the odd surface mapping party was sent by oil companies into the Mackenzie region. Since 1947, when the Leduc field was discovered in central Alberta, oil companies pushed their exploration farther and farther north into northwestern Alberta and northeastern British Columbia. It was not until the second half of 1951, that this interest in northern exploration affected the Mackenzie Basin of the Territories to any extent. Although drilling and geophysical surveys have been important in the exploratory ventures, only the geological mapping will be discussed here.

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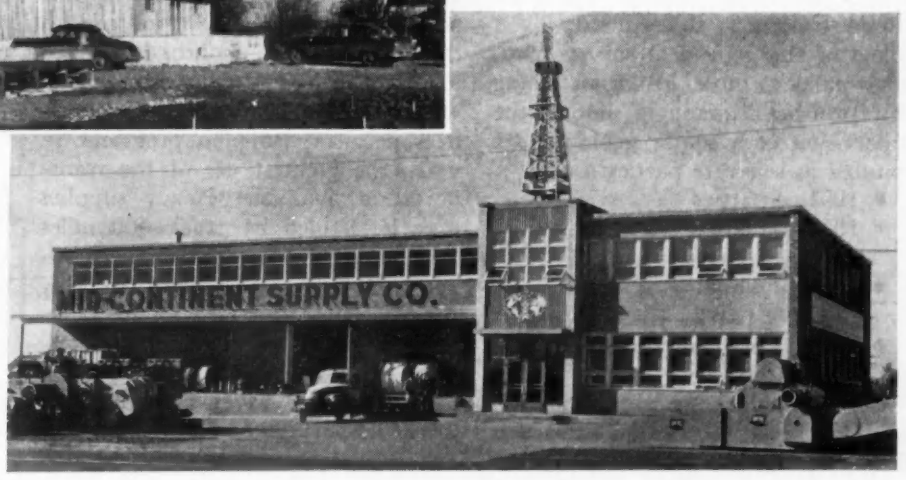

RIGHT—Modern Supply Store and District Offices at Edmonton, Alberta

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HELICOPTER TAKES OFF from small outcrop studied by geologist in northern Canada. Work horse of the exploration party, the helicopter transports geologists to small but important outcrops, enables field personnel to spend a greater part of their time at work than traveling to and from outcrops.

of mapping parties active in the Mackenzie Basin is difficult, for many companies have sent out geologists for exploratory reconnaissance without the knowledge of the government administration. In the estimates given below of the geological survey mapping parties, those geologists doing independent mapping under the supervision of a senior geologist are counted as separate parties:

- **1951:** 4 parties
- **1952:** 4 mapping programs, 11 parties
- **1953:** 7 mapping programs, 18 parties
- **1954:** 5 mapping programs, 19 parties

Oil companies engaged in this mapping in the Territories at various times during the past four seasons include Imperial Oil, Limited; British American Oil Company; Hudson's Bay Oil and Gas Company; Socony-Vacuum Exploration; California Standard Company; Shell Oil Company; Canadian Gulf Oil Company; and Peel Plateau Exploration Company. Two geological consulting firms were also engaged in mapping programs: J. C. Sproule & Associates, and Bullock & Hughes.

Transportation. There are few regions in the world where advance planning of an exploratory program is so essential to its success as it is in the Mackenzie Basin. Since it is possible to spend only from two to three and one-half months in surface mapping each year, depending on the weather and location of the project, it is necessary to plan programs to make the greatest use of the transportation available. Heavy supplies may be hauled by truck 400 miles from Grimshaw on the Northern Alberta Railways northward to Hay River settlement on Great Slave Lake.

From there transportation is by plane or by river boat to points down the Mackenzie River to the Arctic Ocean about 1200 miles distant. An alternate route is river transportation from Fort Nelson, B. C., by shallow draught boat for 350 miles to Fort Simpson on the Mackenzie River, thence by normal river barge to down-river points. A late breakup may delay opening of water navigation on Great Slave Lake until the latter part of June, although it is usually open by mid-June. Breakup occurs on the major rivers in late May. Freight may be handled by commercial carriers on a poundage basis or by contract.

Most survey parties base field operations at Mackenzie River points serviced by river boat and plane for convenience and economy.

Geological mapping programs are faced with two major obstacles:

- Difficulty in finding outcrops in the flat areas.
- Difficulty of transportation in both the flat and hilly or mountainous areas.

The first obstacle is partially solved by the use of air photos. The second is one which has delayed large-scale mapping of the North for many years for much of the Mackenzie Basin is not suited for horse transport, being covered by great stretches of swamp and muskeg without horse feed. Although many streams are navigable for much of their length by canoe, others are full of rapids and shallows. Many outcrops are distant from navigable streams. Conventional float-equipped aircraft is of great advantage where there are a sufficient number of lakes of suitable size and depth for landings from which outcrops can be easily reached by foot. However, over great areas in the Mackenzie Basin, water landings by conventional aircraft are impossible.

Helicopters widely used. The helicopter has now become standard equipment for geological mapping in the Mackenzie Basin. With its use, all outcrops have become easily accessible to the geologist. In fact, the use of a helicopter has made it possible to examine all outcrops without consideration of their location. One make of helicopter commonly used in northern Canada has a normal range of 150 miles, a cruising speed of 70 miles per hour and a pay load of 400 pounds at low to moderate altitudes. Because of the restricted range, gasoline caches have to be distributed at strategic localities, usually at lake shores or stream banks accessible to conventional aircraft or boats. Where it is necessary to employ aircraft to distribute gasoline caches, it has been found most economical to use ski-equipped planes before breakup.

The most advantageous use of the helicopter depends on survey requirements, topographic conditions and

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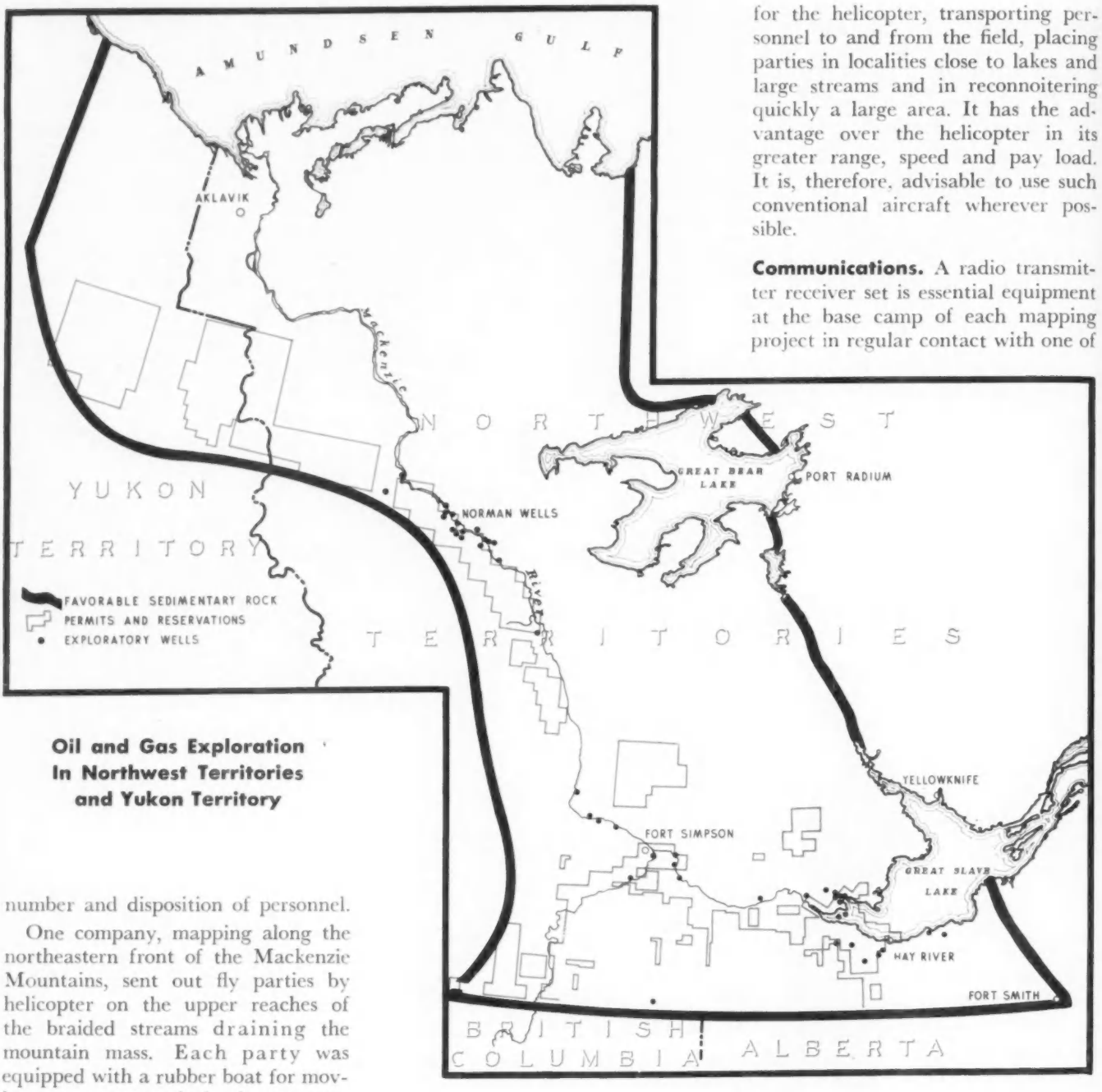


Oil and Gas Exploration In Northwest Territories and Yukon Territory

number and disposition of personnel.

One company, mapping along the northeastern front of the Mackenzie Mountains, sent out fly parties by helicopter on the upper reaches of the braided streams draining the mountain mass. Each party was equipped with a rubber boat for moving camp progressively downstream. Radio contact was kept with base camp and the parties were serviced by helicopter when required. The helicopter was used often to fly parties to the top of high mountain sections so maximum time could be spent in observing and recording the geology during descent on foot. The senior geologist made extensive use of the helicopter for low level reconnaissance and for approximate measurement of sections using the aircraft altimeter.

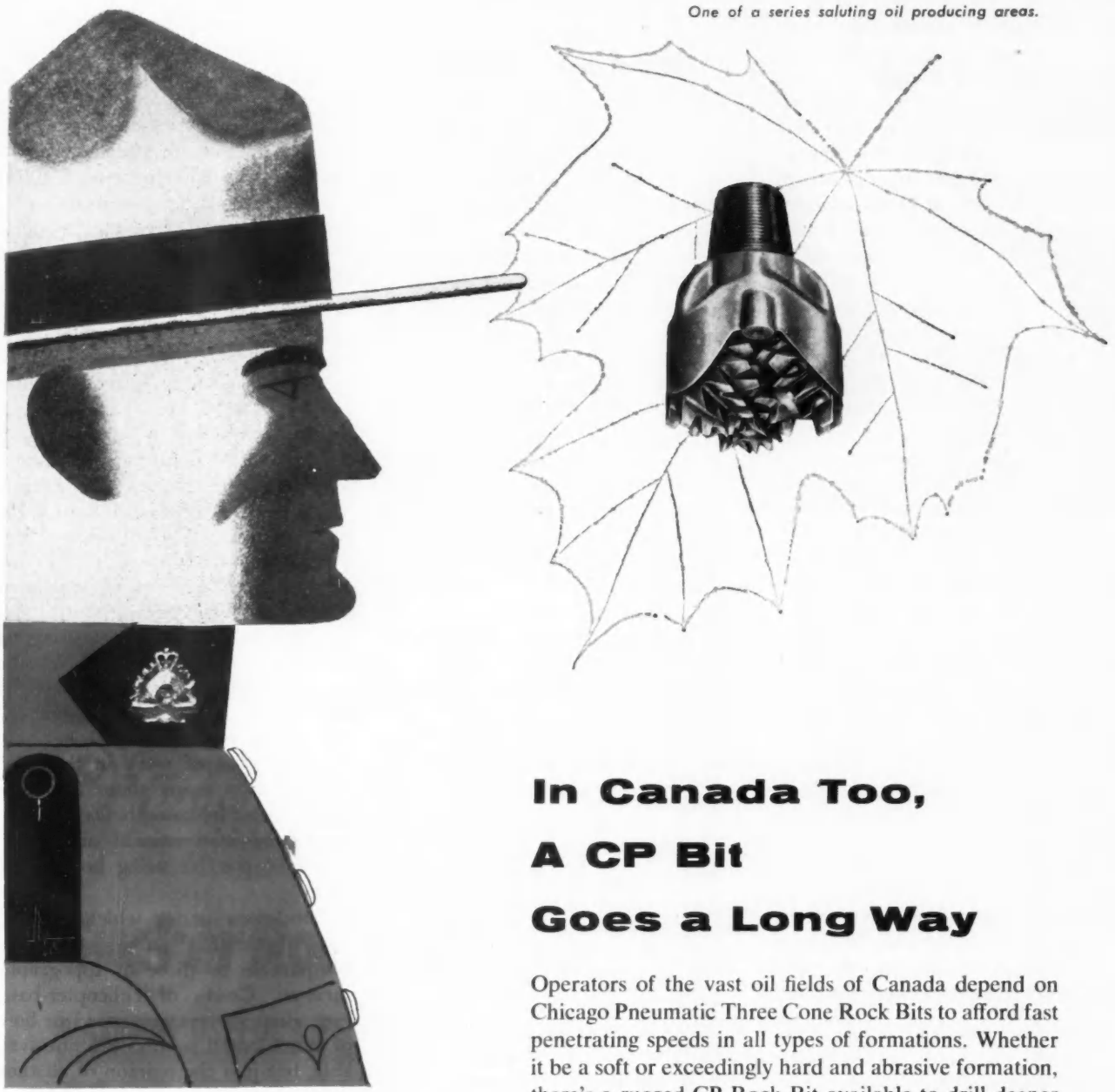
Another company using a base camp close to the mountain front used the helicopter to fly two parties into the mountains early each day for stratigraphic mapping, then flew the senior geologist to reconnoiter and to search for isolated outcrops in the flat muskeg-covered country. All parties were brought back to camp each evening.

Most companies have found it advisable to use conventional aircraft in conjunction with their helicopter-based surveys. One type of plane commonly used has a range of 500 miles, a speed of 110 miles an hour, and a pay load of 1100 pounds when all fuel tanks are full. It is of use in servicing the base camp with supplies and mail, flying gasoline caches for the helicopter, transporting personnel to and from the field, placing parties in localities close to lakes and large streams and in reconnoitering quickly a large area. It has the advantage over the helicopter in its greater range, speed and pay load. It is, therefore, advisable to use such conventional aircraft wherever possible.

Communications. A radio transmitter receiver set is essential equipment at the base camp of each mapping project in regular contact with one of the many RCC Signals (Army) stations located throughout the North. It may be used to receive and transmit weather reports, to maintain contact with the field office, to facilitate ordering and delivery of supplies, and for emergency messages. Satellite radio sets are employed on some projects to maintain contact between base camp and fly camps, especially in areas where weather is uncertain and servicing by plane is unpredictable.

As there is complete vertical air photographic coverage of the Mackenzie Basin, it is now standard pro-

One of a series saluting oil producing areas.



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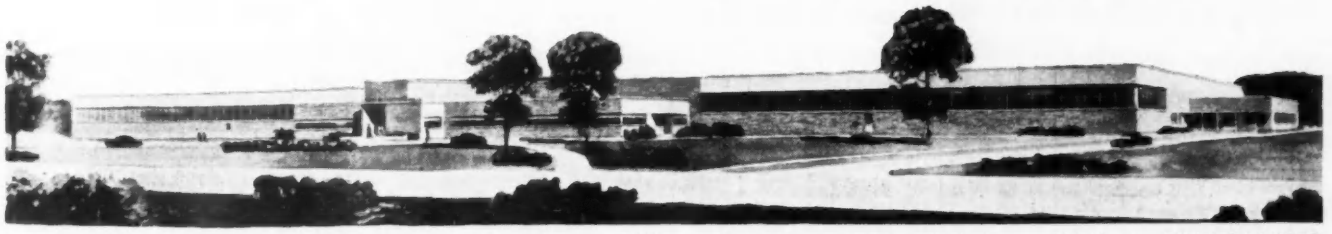

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cedure for all geological parties to make use of mosaics and stereoscopic pairs in the field. Contact vertical photographs on scales ranging from a half mile to one mile to the inch may be obtained from the Air Photographic Library, Department of Mines & Technical Surveys at Ottawa. Many companies have photogeological surveys completed prior to field mapping. Such surveys have been found advantageous in outlining outcrop areas, structures and even formational boundaries. Field mapping serves to check such results, fill in gaps and give greater structural and stratigraphic detail.

Semi-matte photos serve as an excellent base for recording structure measurements, formational boundaries, and outcrop outlines in the field. Some geologists prefer an overlay of tracing paper, linen or other transparent material for recording.

Stratigraphic measurements are normally made using tape and Brunton compass or a measuring stick. For less accurate measurements across appreciable thicknesses, many use the aneroid barometer. One geologist claimed he could get good approximate measurements across near horizontal sections in the mountains by using the altimeter of the helicopter while in flight. The helicopter is of advantage in following key horizons or contacts for considerable distances in the hilly and mountainous country, aiding in correlation between sections.

Costs. It is not possible to give accurate figures on exploration costs; however, some rough estimates can be given for benefit to those considering mapping programs in the north. During the 1954 season, it is estimated that the five companies engaged in geological mapping programs employed 19 geologists and 20 assistant geologists, and utilized five helicopters, four conventional aircraft, as well as other aircraft for charter trips. The cost of these operations probably totalled between $600,000 and $700,000.

The greatest single cost is transportation. The average operation during the 1954 season employed one helicopter and one conventional air plane, so it would be advantageous to examine such costs. One charter aircraft company supplies a helicopter with pilot and mechanic and with fuel supplied at the nearest agency for $7000 per month, plus $16.60 per hour flown in the Fort Simpson region. Assuming a utilization of 120 hours per month for three months, the helicopter would cost about $27,000. Transportation costs on the aviation fuel would be extra. The basic tariff would also be higher for more northerly regions.

Similarly, a conventional aircraft and crew, assuming a utilization of 100 hours per month at $75 per hour for three months, would cost $22,500. The basic cost for a helicopter and a plane for a season's mapping in the southern part of the Mackenzie Basin would then be in the order of $50,000. Charges for transportation, including aircraft charter, freight, personnel travel, and charter or purchase of water craft, would likely average $75,000.

Other major costs in an exploration program are salaries, supplies, equipment, and administrative expenses. Total cost of a four-party mapping program designed to cover a maximum amount of ground, utilizing a helicopter and conventional aircraft, would range from $100,000 to $175,000. Despite such high costs, experienced operators now consider it economical to use modern aircraft when the cost of mapping each unit of area is compared with the cost, using the old conventional modes of travel. One government topographic surveyor of many years' northern experience said that with given personnel he could do a program of work in the Mackenzie region many times as fast at half the cost by using helicopters and supporting conventional aircraft, as would be possible using horse transport.

Conditions under which oil company geological parties work are comparable to those of topographic surveys. Costs of helicopter-based geological surveys compared to horse or canoe-based surveys are not available, but it is the opinion of all those with experience that costs are reduced by using helicopters on any given small scale geological mapping program in the Mackenzie Basin.

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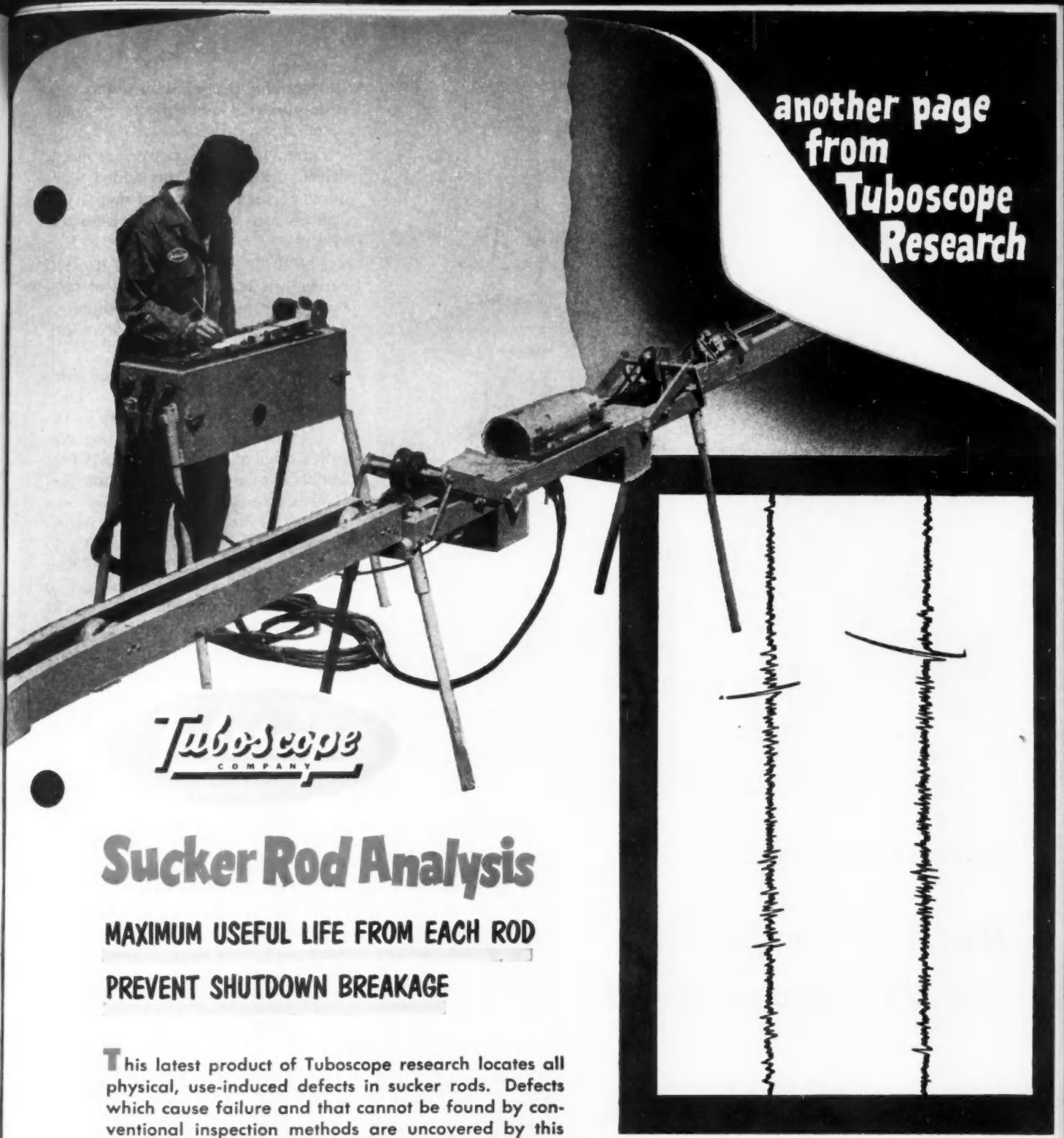
—The End

About the Author

DR. ARTHUR B. IRWIN, petroleum conservation engineer for Northwest and Yukon Territories, Department of Northern Affairs and National Resources, Edmonton, Alberta, is a 1937 graduate of the University of British Columbia, where he studied mining engineering. Following graduation from college, he spent more than three years with Anglo American Corporation of South Africa on mineral exploration in northern Rhodesia and Nyasaland. During World War II, he served with the Royal Canadian Engineers. He obtained his M.S. degree at the University of British Columbia in 1947 and his Ph.D. at McGill University in 1950. He joined the Geological Survey of Canada in 1950. He is now headquartered at the Macdonald Hotel, Edmonton.

Drilling for Oil and Gas—Northwest Territories and Yukon Territory—Jan. 1, 1954 to Sept. 30, 1954

NAME	Permit No.	LOCATION		ELEVATION		Date Started Drilling	Finished	Date Rig Release	Total Depth Feet	Casing Details	Remarks
		Latitude	Longitude	Grnd.	K.B.						
Westerol Liard Rapids 1A	374	61° 27′ N	121° 47′ 40″ W	770	777	23 Mar 53	10 Mar 54	10 Mar 54	2467	7″ @ 470′ C125	Abandoned
N.W.T. Heart Lake 1	322	60° 48′ 18″ N	116° 35′ 6″ W	796	805	31 Jan 54	24 Feb 54	25 Feb 54	1757	7″ @ 65′ C25	Abandoned
Imperial Island River 1	286	60° 09′ 29″ N	121° 08′ 16″ W	2280	2288	5 Mar 54	16 Jun 54	10 Jul 54	8233	13⅜″ @ 592′ C300 7″ @ 5542′ C200	Abandoned
N.W.T. Desmarais Lake 1	654	60° 48′ N	116° 48′ W	851	859	7 Mar 54	31 Mar 54	1 Apr 54	2610	7″ @ 69′ C22	Abandoned
N.W.T. Escarpment Lake 1	323	60° 35′ 43″ N	116° 13′ W	888	896	10 Apr 54	26 Apr 54	30 Apr 54	2085	7″ @ 59′ C40	Suspended



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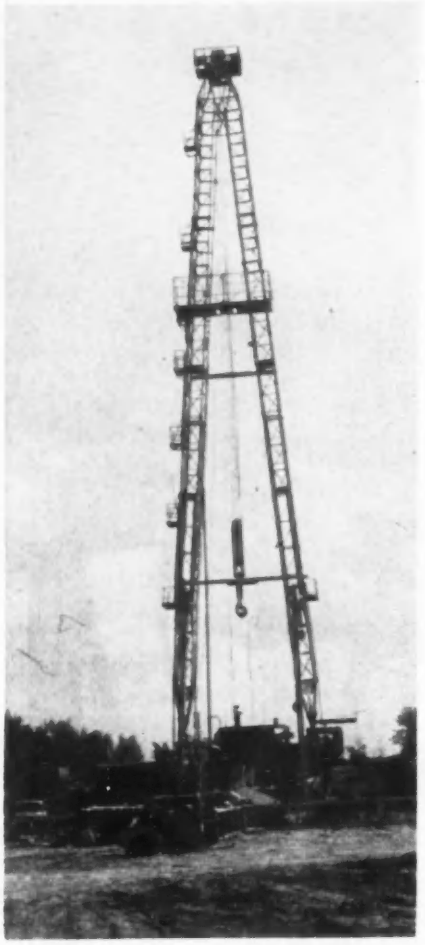
THEN—Old Rig 17 in 1948



NOW—Old Rig 17 in 1954

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Today, little remains of the original rig, except the number. An old steam drawworks, converted to power, was used between 1948 and 1953. Two 170-horsepower diesel engines in compound, a 250-horsepower pump and a conventional derrick with timber substructure were other pieces of equipment on the early rig.

A. J. (BUD) BROWNBRIDGE, veteran pusher and one of three remaining original members of Rig 17's crew, is getting accustomed to the new version of the Leduc field record-setting rig.

Later, for more power, a diesel-driven drilling unit was added. Bulldozed earthen settling and suction pits cribbed with timber was used for several years.

The drilling crew early in Rig 17's career was largely composed of farm boys better acquainted with threshing machines and milking stools than with mud pumps and drill pipe.

Of the original crew at Leduc, three are still with old 17. A. J. (Bud) Brownbridge, a familiar figure in Devon, Leduc or Calmar, is pushing tools in his original capacity. C. G. (Chet) Poche and D. J. (Doug) Hanson, derrick men on the first well, have been drilling for six and five years, respectively. Eight others of the first Rig 17 crew are on other General Petroleums rigs, three as toolpushers and five as drillers. So through the years Rig 17 has served well as a training ground.

The challenge of reduced footage prices and increased competition has been met with continuing efficiency by crew and equipment. Many changes have been made in the rig as obsolete equipment was exchanged for the latest in drilling machinery. Rig 17 now boasts a modern drawworks, two 325-horsepower diesel engines, 138-foot fullview drilling mast on a 10-foot steel substructure, and two fully-equipped steel mud tanks.

Proving that familiarity with a rig breeds efficiency, Rig 17 and its crews have cut in half the time required for drilling D-2 wells and sliced 40 percent off the D-3 wells. Average penetration rate from surface to total depth has been doubled from 17 feet an hour in 1948 to 34 feet in 1954. Jet bits have been used to advantage. Drilling mud control has progressed to an optimum for hole condition and fast drilling.

Weight on bit, rotary speed, circulation rate, and nozzle velocity have been studied to get an optimum for each formation. All of these factors made Rig 17 a leader in Leduc field. And its crew members are mindful of the reputation dug out of the Leduc depths. That is why Rig 17's genial toolpusher Bud Brownbridge disgustedly watches any weather threat that may keep him and his crew from "makin' hole." —**The End**

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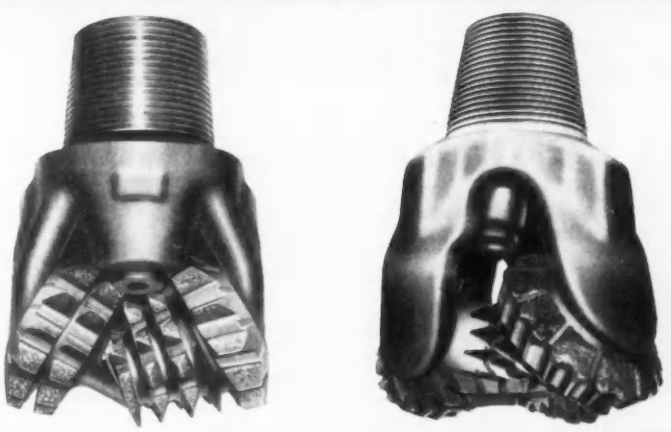

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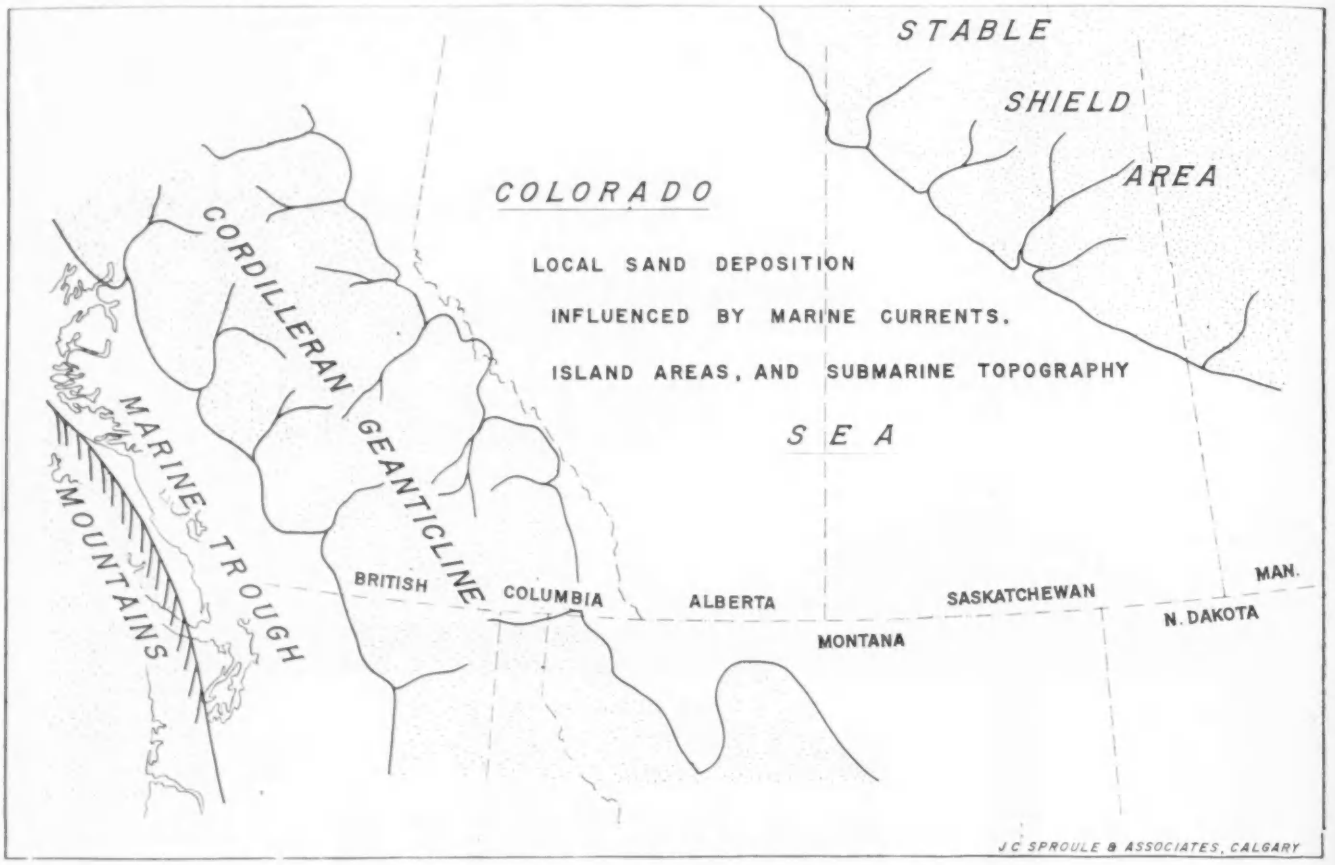

Fig. 1—Western Canada, diagrammatic paleotopographic map, approximate Cardium time.

Cardium Correlation Sheds Light on Pembina Potential

Understanding of source sand occurrence ultimately may lead to finding similar occurrences in other Cretaceous horizons.

By J. C. SPROULE, J. C. Sproule & Associates, Ltd., Calgary

THE CARDIUM SAND formation is, to most who have heard of it, inseparable from the Pembina area of Western Alberta where the formation was first discovered to be productive of petroleum. It was in May, 1953, that Socony-Seaboard-Pembina 1, a wildcat well, located about 70 miles westsouthwest of Edmonton, was completed as a producer of high gravity crude from the Cretaceous Cardium sand. This discovery is undoubtedly the most significant oil exploration event that has taken place since the Devonian limestone reef discovery at Leduc in 1947. It has opened an entirely new vista of opportunities to oil operators of the region.

The Leduc reef discovery initiated a frenzied search for Devonian reefs, by geophysical, surface geological and regional subsurface geological research methods. This reef search has taken place mainly in relatively well-settled areas where a fair proportion of the mineral rights is in private hands, although the greater part of it is in the hands of the Crown. This search has resulted in the establishment of approximately 2.5 billion barrels of reef oil reserves in the seven years since 1947.

By comparison, the establishment of proven and semi-proven Cardium reserves of nearly a billion barrels of recoverable oil within the first year following the Pembina Cardium discovery is generally accepted. The search that has followed this discovery is no less systematic than that which followed the discovery of reef oil but, due to the nature of the sand body, the terrain and the resultant access difficulties and to Crown ownership of most of the prospective lands concerned, exploration and development

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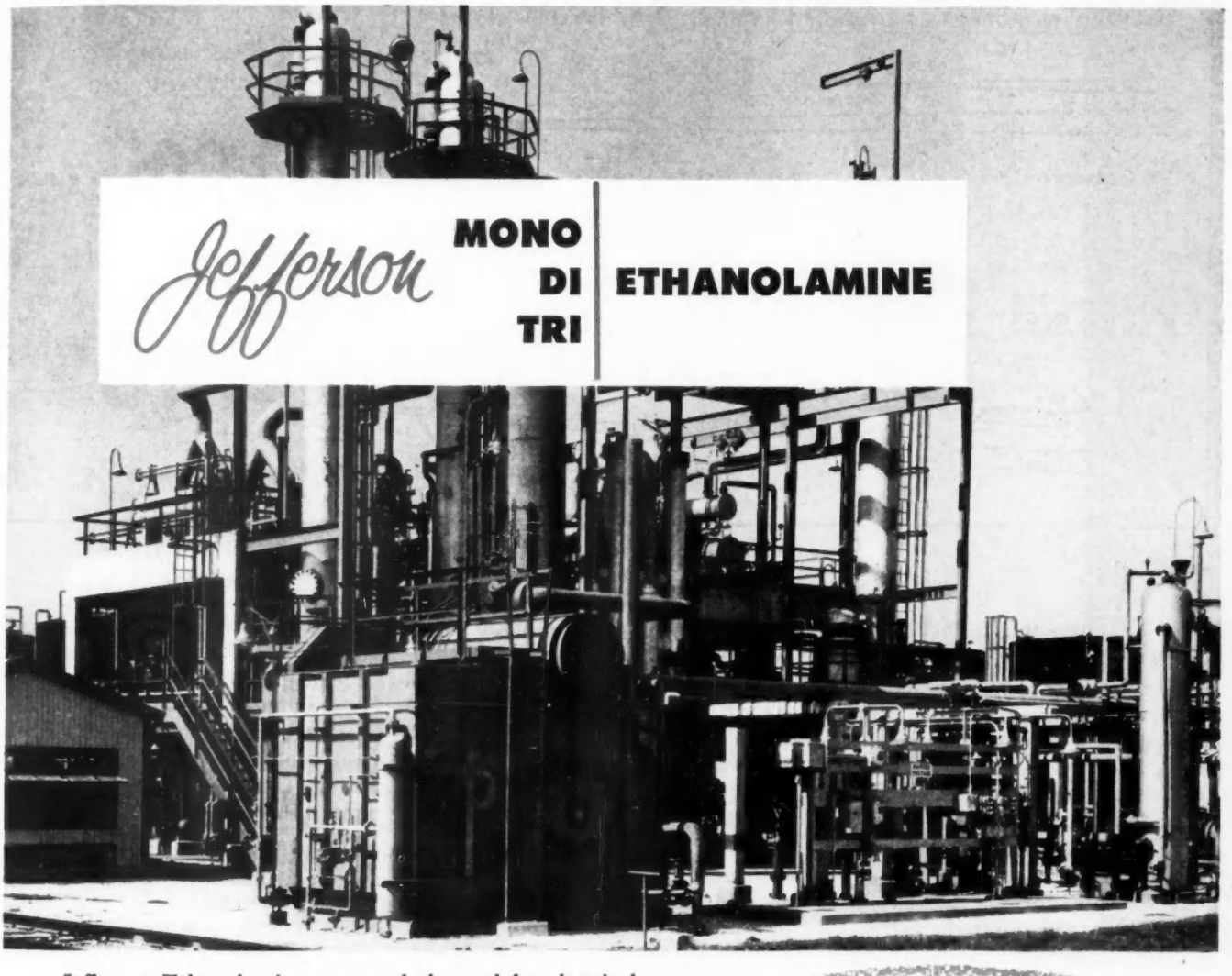

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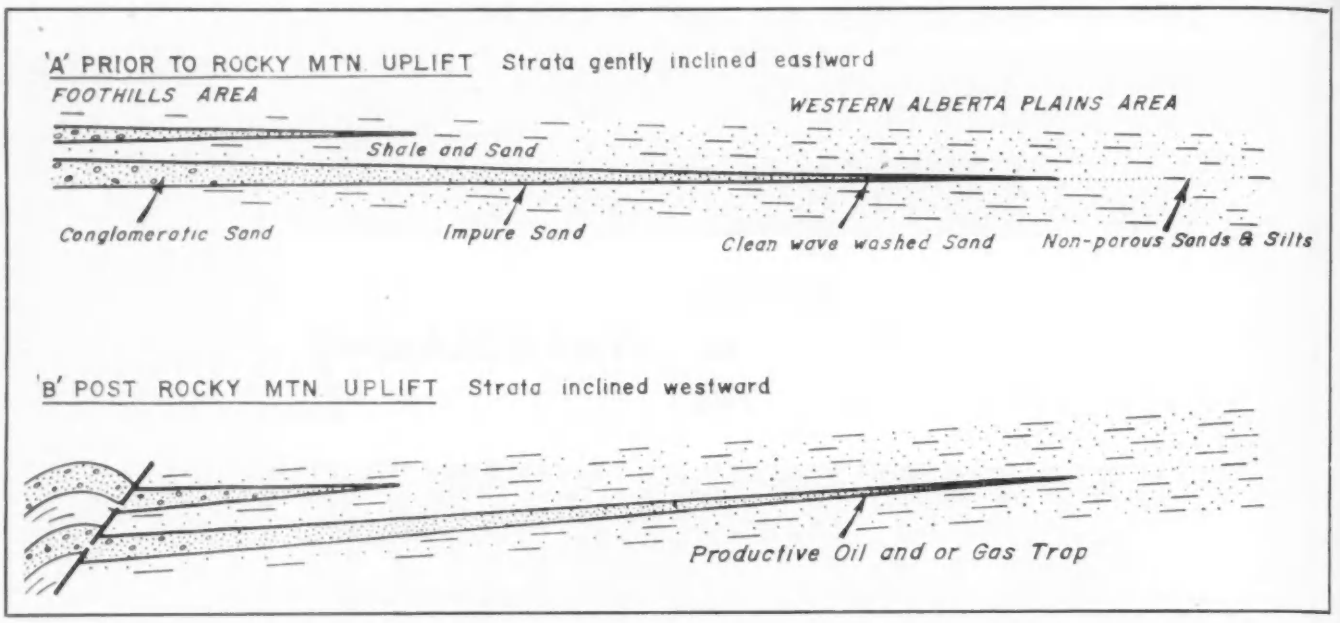
'A' PRIOR TO ROCKY MTN. UPLIFT Strata gently inclined eastward
FOOTHILLS AREA
WESTERN ALBERTA PLAINS AREA
Shale and Sand
Conglomeratic Sand
Impure Sand
Clean wave washed Sand
Non-porous Sands & Silts
'B' POST ROCKY MTN. UPLIFT Strata inclined westward
Productive Oil and or Gas Trap

Fig. 2—Diagrammatic cross-section showing two-stage history of Cardium formation.

operations have thus far affected relatively few companies.

As a measure of industry interest in this new discovery, the past year's Crown sales of mineral rights in the vicinity of Pembina that can be regarded as dependent on the Cardium prospects amount to $33,128,710, of which $24,087,658 resulted from sale of 184,320 Reservation acres and $9,042,052 from the sale of 7840 acres of semi-proven lands in the immediate vicinity of successful wells. Thus, the average price paid per wildcat reservation acre was $130 and the average price per semi-proven acre was $1150.

The original Pembina discovery has been followed by stepout drilling varying from one-half mile to more than 20 miles. A certain amount of offset drilling has been done around the outlying discoveries at Drayton Valley, Buck Creek, Buck Lake, Wolf Creek, etc., although ultimately these will be joined to the Pembina field by in-fill drilling.

Weather curtails activity. To date, only about 81 Pembina area Cardium wells have been drilled, which is probably about half the number that would have been drilled had the area been less difficult of access during the 1954 summer months. Of the 81 wells drilled, 75 have been completed successfully and 6 were dry in the Cardium. Current production figures would not mean much at this time as production has been held up pending completion of a pipe line to Edmonton which was to be completed November 15, 1954. Maximum daily well allowable for October was 200 barrels per day and the average daily well allowable 114 barrels.

It is the purpose here to present a general geological background for an understanding of the Cardium as an oil reservoir and to discuss briefly the exploration, development, land ownership, and other problems related to the production of that oil and the discovery of new pools similar to Pembina.

Geological aspects. The Cretaceous geological section of the western interior Plains is composed of a series of marine and brackish shales, sands and sandy shales, with some sediments of fresh-water origin. The late Lower Cretaceous and Upper Cretaceous portion of the sedimentary cycle comprises mainly marine shales of the Colorado group, deposited over a vast area, extending from the Gulf of Mexico to the Arctic Ocean, in the most widespread interior sea of the Mesozoic period. In Alberta and vicinity this marine shale section is divided into two parts by the Cardium formation, which is a three-member assemblage composed of an upper and lower conglomeratic sand member and an intermediate sandy shale member.

Key to the existence and distribution of the Cardium sand as a hydrocarbon reservoir lies in the geological history of the Cordilleran geanticline, a highland that formed the western shore of the Colorado sea and whose oscillating rise and fall controlled the supply of coarse clastic sediments forming the Cardium conglomeratic sand members.

In illustration of this point, see Figure 1, a paleogeographic restoration of Western Canada at the time of deposition of the Cardium formation. This illustration indicates that the coarser clastic unsorted sediments will tend to be piled close to the western shoreline of the Colorado sea. In the deeper waters to the east of this shoreline, sediments deposited are more uniformly graded sands of progressively smaller grain size, with areas of well-winnowed or wave-cleaned sands that form the more porous reservoirs.

Reservoir in Cardium pinchout. The Cardium owes its existence as a reservoir sand to the tectonic history of the area. In this connection, Figure 2, an east-west diagrammatic cross-section of the shoreline area, shows (a) the easterly-dipping attitude of the Cardium during its deposition and (b) the westerly-dipping attitude of the formation from the Plains to the edge of the Foothills, following the uplift and eastward overthrusting of the Rocky Mountains and consequent downwarping of the underthrust portion of the crust.

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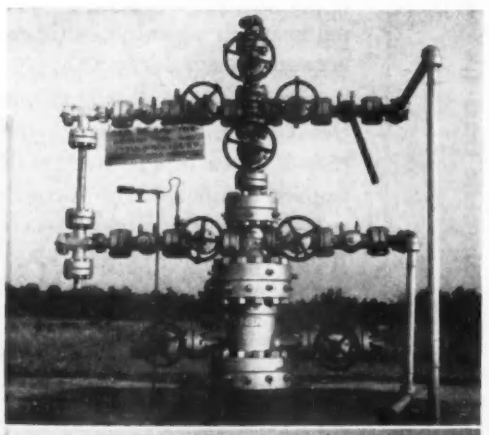

The moral here is, that standard W-K-M Valves will stand up under sour crude service — but, a check on the type of crude is often wise before installing valves for permanent service, as the use of proper trim at the beginning can prevent an emergency shutdown later. Also, as a general practice, it is well not to switch valves from field to field without making sure that the trim is suitable for the service.

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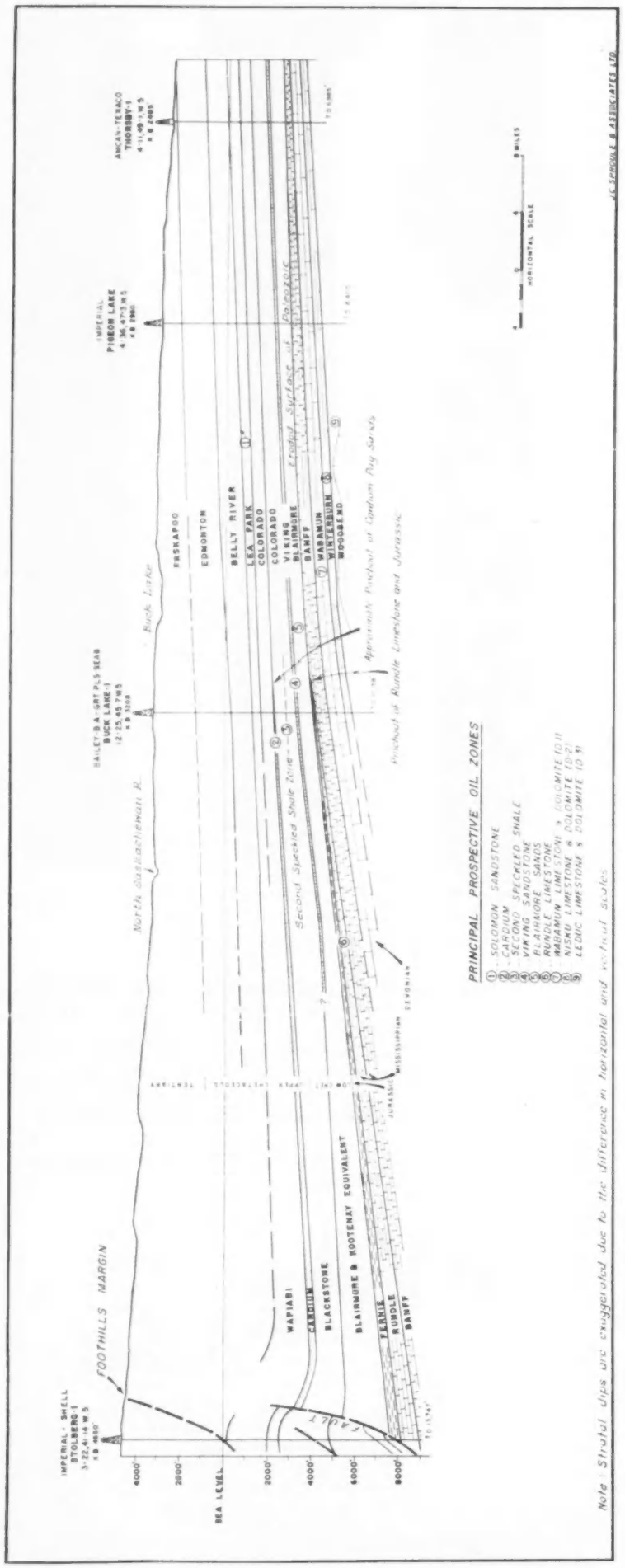

Fig. 3—Semi-diagrammatic cross-section through Pembina area showing principal producing and prospective oil zones.

stratigraphic trap. It permits migration laterally and upward only in the direction of the pinchout of the sands, as the porous sand body is gradually replaced eastward by non-porous shales. Pembina area Cardium sand oil pools are the natural outcome of the process described. The reservoir is in the eastward pinchout portion of the lower of two conglomeratic sand members.

Though a detailed discussion of the geology of Cardium formation is not required here, it is essential to an appreciation of the potentialities of the sand that it be understood that the reservoir is not a continuous ribbon of porous sand. The undulating character of the submarine surface on which the sand was laid down, variations in source of supply and the topographic relief on and adjacent to the Cordilleran geanticline (Figure 1), as well as water currents and other variables, all contribute to cause local variations in the thickness, attitude, grain size, porosity, and permeability of the sand body. With this in mind, a study of the regional paleogeographic features is important to a full understanding of this and similar sand occurrences.

With further regard to the development of the Cardium sand, it is of interest to note that there are several other sands in the Cretaceous stratigraphic section of the same area that were formed in similar fashion. Some of these are shown in the diagrammatic cross-section of Figure 3, presented as an illustration of the principal reservoir objective horizons in the area under consideration.

An idea of the distribution of effective Cardium sand east of the Foothills is given in Figure 4, a net sand isopach combined with a contour picture showing the present structural attitude of the formation. It is of real significance to note that the only substantial irregularity of outline of the pinchout edge, shown here, (although there are others that are imperfectly known) occurs in the Pembina area, the only place where we have fair drilling control.

Other than near Pembina, therefore, the position of the pinchout edge must be regarded as relatively inaccurate. Despite the fact that the wells are widely scattered and to a considerable extent drilled before the Cardium

was recognized as a high-priority target, correlations between wells are good. To illustrate this, the electric log correlation section, Figure 5, was prepared along the line A-B of Figure 4.

This cross-section, based on electric logs, shows clearly, on both Self Potential and Resistance Curves, changes in the sand body from the Foothills to the Plains. It also illustrates that the lower Cardium sand member is more persistent and is responsible for the Pembina field. The potentialities of the upper Cardium sand at the same relative paleogeographic position as the lower sand must be regarded at this time as purely conjectural.

Exploration problems. Principal exploration problems concerned in the search for Cardium oil, exclusive of those relating to exploratory drilling, are due to:

1. **Exploration problems in relation to physiography.**
2. **Exploration problems in relation to the geological section.**
3. **Exploration problems in relation to the nature of the Cardium sand.**

1. Exploration problems in relation to physiography. The area of prospective Cardium sand lies almost entirely in the relatively unsettled wooded area of Western Alberta, as shown on Figure 4. Much of this area is fairly flat, although there is strong topographic relief locally. Scarcity of culture also means a scarcity of roads. Over much of the area, therefore, roads still must be built. The only real obstructions to all-weather road building are the moss- and tree-covered marshy areas known as muskegs which occupy approximately 12 percent of the area. These muskegs are variable both as to depth and distribution.

The remainder of the area, although wooded, is not difficult of access if road cuts are made wide enough to permit the sun and air to dry them out. In the western portion of the Pembina field there is an unusual percentage of muskeg, as shown on the air photograph (see Figure 6). It centers on the main part of the Pembina oil field. The boundary between the farm land area and the unsettled wooded area to the west is shown on this photograph.

Although muskeg is a problem in structure drilling and geophysical operations during the summer, such work can be and is being carried out in the winter time on an efficient but somewhat more costly basis. Relatively high rain-fall and wet nature of the surface over much of the area does give the region some advantage insofar as seismic results are concerned. The high water table tends to improve the character of the seismic records, as compared with those in parts of the more arid areas to the east, where the stratigraphic section is otherwise similar, with the exceptions noted below.

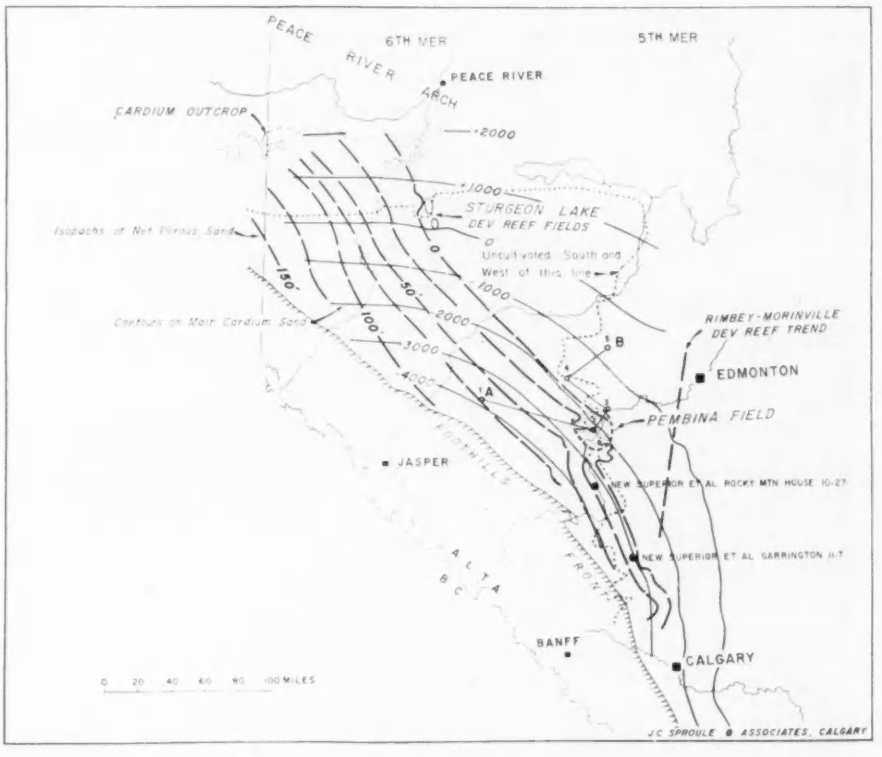

Fig. 4—Combined Isopach and regional structure contours Cardium formation, Alberta.

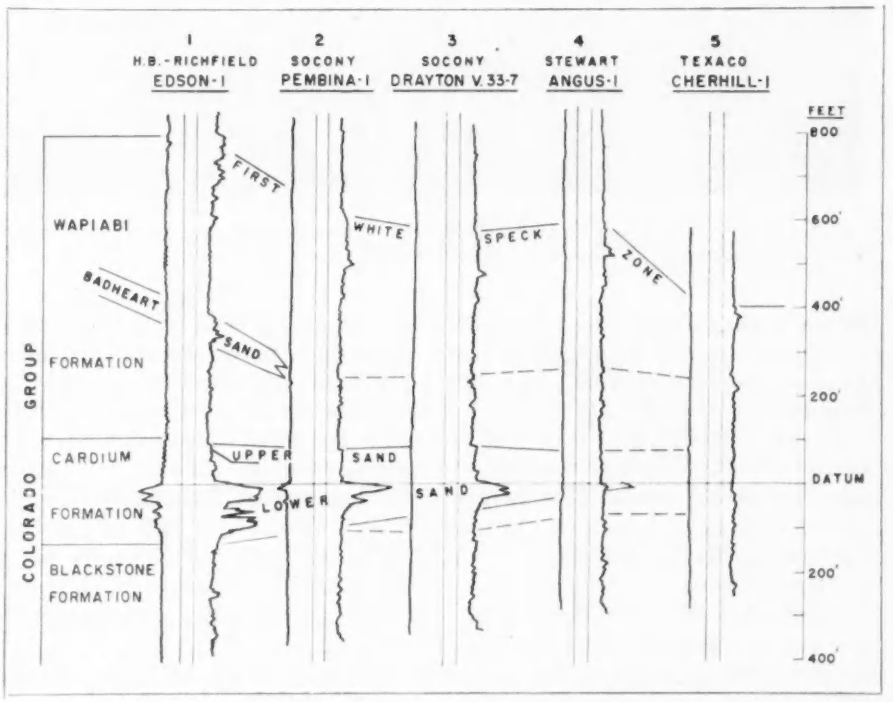

Fig. 5—Cardium correlation section of foothills through Pembina area.

2. Exploration problems in relation

Fig. 6—Aerial photograph Pembina field area. C—cultivated ground; R—road; T—Trail; M—Muskeg; W—wooded; D—drainage; O—Present outline Pembina field.

to the geological section. The stratigraphic section overlying the Cardium sand is composed of about 5300 feet of interbedded sands and shales of a type that tend to render it difficult to obtain good seismograph records. In addition to this difficulty, an increase in the sand content from east to west appears to effect a fairly rapid lateral change in seismic velocities.

Although structure drilling is a useful tool in the area, the thick section of interbedded and cross-bedded Upper Cretaceous sands and shales reduces the value of this method as an exploration tool, by comparison with its use in Eastern Alberta and the Plains of Saskatchewan and Manitoba.

Value of the gravitymeter in this area has not been proven. Nor are present operational and computing methods likely to render it of much value when used as a purely local tool. It would appear likely, however, that the gravitymeter and possibly also the magnetometer will, when used on a large scale, prove of value in tracing significant regional trends.

Use of surface geological methods, particularly when combined with photogeological methods, in areas of outcrop and near-outcrop, has already proven itself. The bedrock is concealed over much of the area, but a preliminary examination of air photographs indicates the presence of outcrop.

3. Exploration problems in relation to the nature of the Cardium sand. The fact that the Cardium sand is a stratigraphic pinchout feature involving a relatively slight change in lateral sedimentation makes it almost impossible to detect, at the point of pinchout, by presently known geophysical exploration methods. The detection of structural features involving Cardium sand in areas where it is porous, however, can undoubtedly be made by geophysical methods.

Meanwhile, it would appear that one of the most important exploration tools used in tracing the pinchout margin will be deep drilling. Slim-hole drilling has not yet been adapted to this problem or this area, but it probably will be.

Muskeg slows activity. Problems of development to date in the Pembina field have been mainly those involving accessibility due to the prevalence of muskeg which is in places almost impassable in summer. As a result of this situation about 15 rigs were marooned and idle over a period of three months in the vicinity of the Pembina field during the past summer season.

There are no particular mud or other drilling difficulties involved in drilling to the Cardium sand. The average completion time is 24 to 25 days, with the actual drilling time about 17 days. The average completion cost of a Pembina Cardium well is $90,000, which includes pumping equipment and road work. This cost figure will undoubtedly be reduced in the drilling of future wells.

Reservoir characteristics. The Cardium reservoir in the Pembina area is a medium to fine-grained quartz sandstone. On basis of presently available figures, the porosity varies from 4.3 percent to 25.9 percent, the weighted average being in the vicinity of 15 percent. Due to the presence of irregular amounts of clay and some silica in the matrix, the permeability is irregular and, in general, low. The average net reservoir thickness will be 20 feet.

Connate water content is approximately 26 percent, although it is probable that when further data is available this may be substantially reduced. The shrinkage factor used is 80 percent. On the basis of the above, the 37 degree gravity oil is given a recovery factor of 25 percent. It is probable that development of new completion methods will eventually give the field a higher recovery factor. As matters stand, the low permeability of the sand and its competent character make it an ideal subject for the application of new formation fracture methods.

It should be understood that, as this is a new field, much of the reservoir information is still closely held and when it does become available figures will be changed. On balance the fig-

ures used here are intentionally conservative.

Land ownership. Mineral rights within the area of prospective Cardium sand are owned mainly by the Crown and the area is blanketed to a considerable extent by reservations varying in size from 6000 acres to 100,000 acres. The greater part of it is held by major companies, although the area is so large that most companies will be forced to go to lease before they have satisfactorily evaluated their reservation properties. This will mean, in turn, that some of the lands will be retained in undeveloped lease-block form while somewhat more than 50 percent of the intermediate area will revert to the Crown.

Other reservations may revert to the Crown for non-performance. Reversion acreage will then become available to the public in parcels of various sizes at Crown lease sales and sales of reservations and drilling permits. At that stage, competition for such acreage will depend on interim development and on exploration knowledge of competing companies.

To recapitulate, the problem is now in the hands of those who hold reservations, but the lands that revert to the Crown in the future will be passed to others who choose to carry out the search in the areas between the retained lease acreage.

Prospects for similar reservoirs. Inasmuch as the Cardium and similar sand reservoirs are related to structural features as broad and as widespread as the Cordilleran geanticline, the Basin of the Colorado Sea, the Rocky Mountain Uplift and numerous subsidiary features of all of these three major physiographic units, the possibilities for future discovery and development of such reservoirs are almost unlimited.

The relationship of sand reservoirs to source beds is at this time unknown. Some of the hydrocarbons are undoubtedly contemporaneous with the host rock and others are equally certain to be the result of migration from underlying and/or nearby reef and other source bodies.

In consideration of the variety of structural and stratigraphic features in the general region between the Cardium pinchout and the Foothills belt, and of the variety of known source horizons in the same area, it appears certain that the area has great potentialities, both in the Cardium and in other similar sand bodies.

We venture to say, without hesitation, that the reserves that will be discovered in sands and reefs within the relatively unexplored area between the Cardium pinchout and the Rocky Mountains should, within the next ten years, amount to several times the reserves now assigned to all of Western Canada. This anticipated performance is based on the supposition that normal market requirements will supply the incentive to conduct the necessary exploration work. —**The End**

About the Author

J. C. (CAM) SPROULE was born in Edmonton, Alberta, and received his grade school and early university education within the province. After graduating in Honors Geology from the University of Alberta in 1930 he took an M.S. and a Ph.D. in 1935 at the University of Toronto. His early field, begun in 1927 as a student assistant with the Geological Survey of Canada, ended in 1939 when he left the staff at Ottawa to enter the commercial field with Imperial Oil Limited, in Western Canada.

He was exploration manager for Imperial's Williston Basin play when the Saskatchewan exploration group was transferred to Alberta in 1945, when he served as head of Imperial's Western Canadian subsurface department until transferring to the Toronto head office of International Petroleum Company. He left his position as chief advisory geologist to International Petroleum Company in August, 1951, and returned to Calgary to open a consulting practice. He now heads the geological and exploration consulting firm of J. C. Sproule & Associates Ltd. in Calgary.

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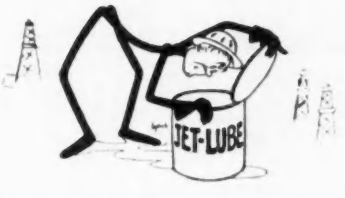

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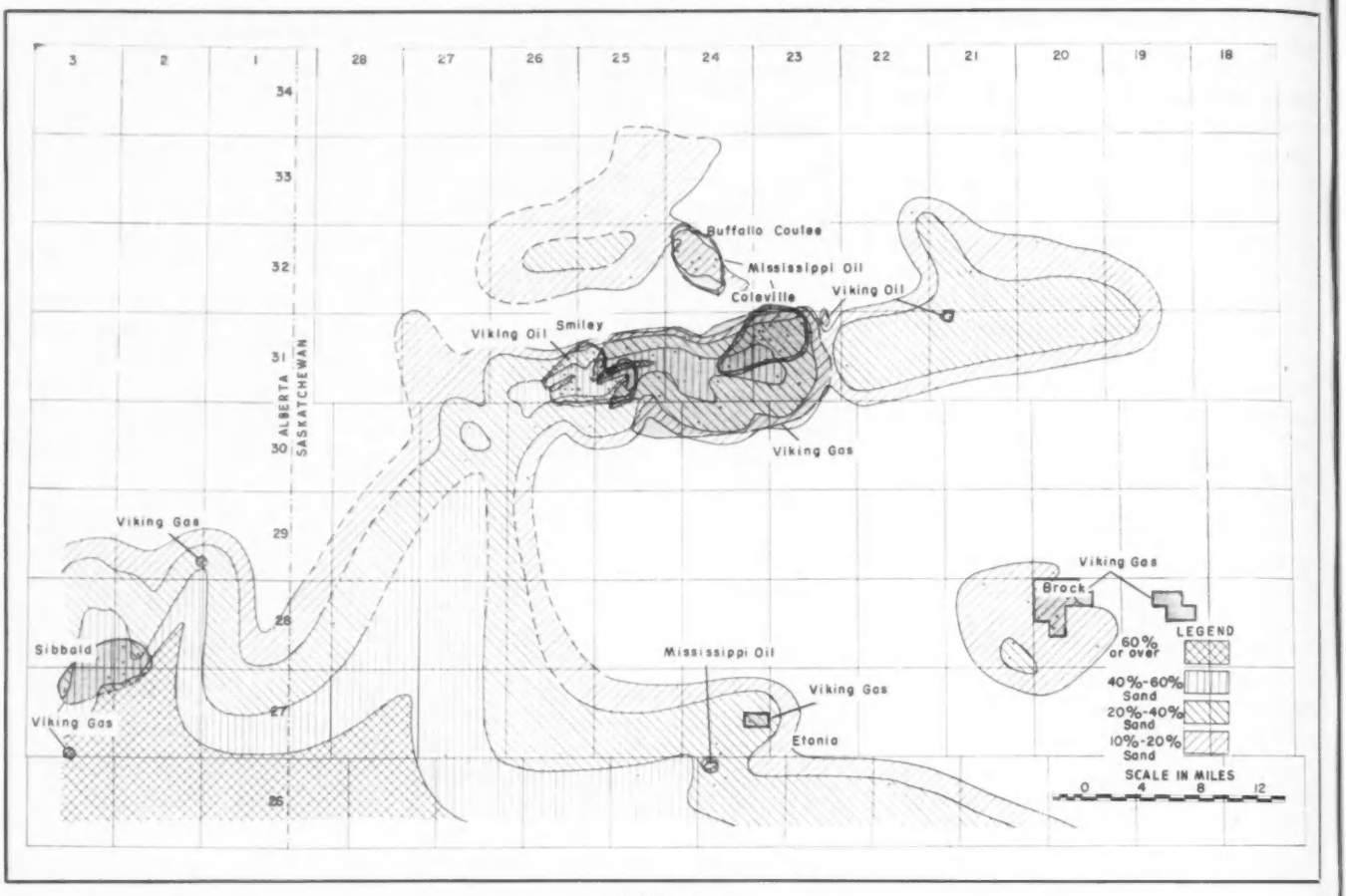

FIGURE 1

Smiley Is Important Light Crude Reserve

Drilling problems in this Saskatchewan oil field are being solved. Here's how.

By A. D. HUNT and M. K. TAYLOR

THE SIGNIFICANT fact about Smiley field is, perhaps, that it is the first light gravity (average 32) reserve of appreciable size to be found in Saskatchewan. The discovery well, Smiley 7-15V, was spudded in September, 1953, by Imperial Oil Company, Limited in conjunction with Canada Southern Oils Ltd. (now Canso Oil Producers Ltd.) and the Royalite Oil Company, in a gas development program.

Since then, 118 wells have been drilled within field limits, of which 103 are now on regular production, giving approximately 3000 barrels per day. Oil production is obtained from the Lower Cretaceous Viking sand, having an average thickness of 35 feet. The sand is encountered between 2100 to 2500 feet with an average depth of 2300 feet. Full limits of the field have yet to be defined, but present development covers approximately 8000 acres. The field is situated about 20 miles east of the Alberta-Saskatchewan boundary and some 200 miles north of the International boundary.

A detailed geological account of the field has already been published.[1] In brief, the Viking sand consists of fine to medium-grained quartz sand with a shale content varying from 20 percent up to 60 percent within the field limits (Figure 1). The sand was deposited in the form of an east-west elongated bar which pinches out both north and south but is connected to the main Viking sand body to the south by a relatively narrow neck. The larger portion of this bar contains natural gas, and the Smiley field should be considered as an oil leg in association with a very large natural gas cap.

Structure of the Viking sand is complicated (Figure 2) since it is controlled by an underlying buried Paleozoic land surface. In fact, the contours on the Viking sand reflect to an extraordinary degree every hill and valley of that old surface.

The Viking sand is divided into two main zones, the Viking sand proper

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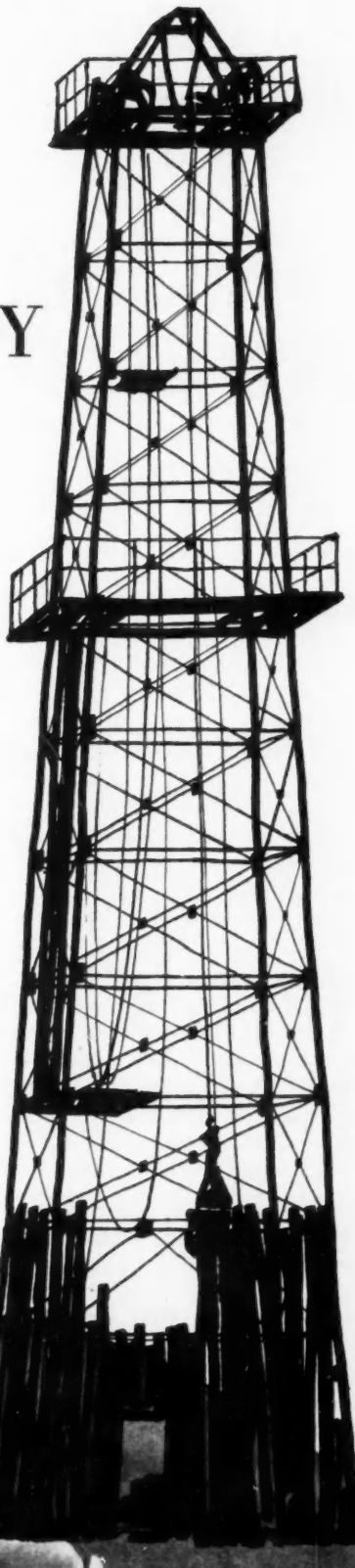

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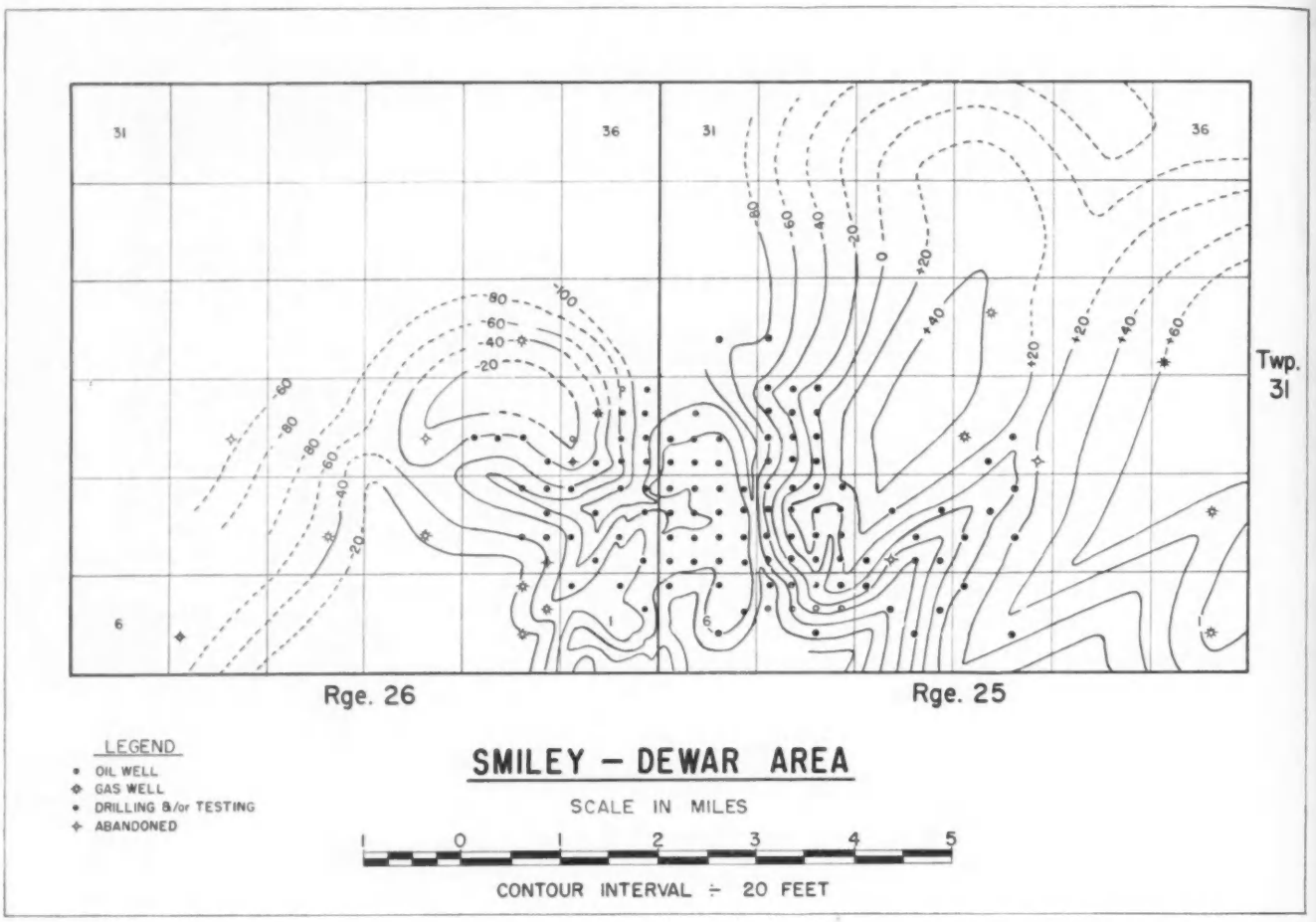


FIGURE 2

and the Basal Chert, separated by a three-foot bentonitic shale band. The Saskatchewan Conservation Board presently considers the two zones as separate reservoirs. Gas/oil and oil/water contacts are known to vary throughout the field, but they will not be finally established until the field is fully developed.

Wells drilled in five days. The wells are drilled to total depth in an average of five days, which includes cementing approximately 200 feet of 10¾-inch surface pipe and a 7-inch production string. Barefoot completion has been tried, but is not considered generally applicable, due to the nature of the sand and the varying gas/oil and oil/water contacts in both zones. An average of one well per section has been diamond cored. Good recovery is obtained from the sand, but poor recovery in the chert, due to the larger chert pebbles and the more unconsolidated nature.

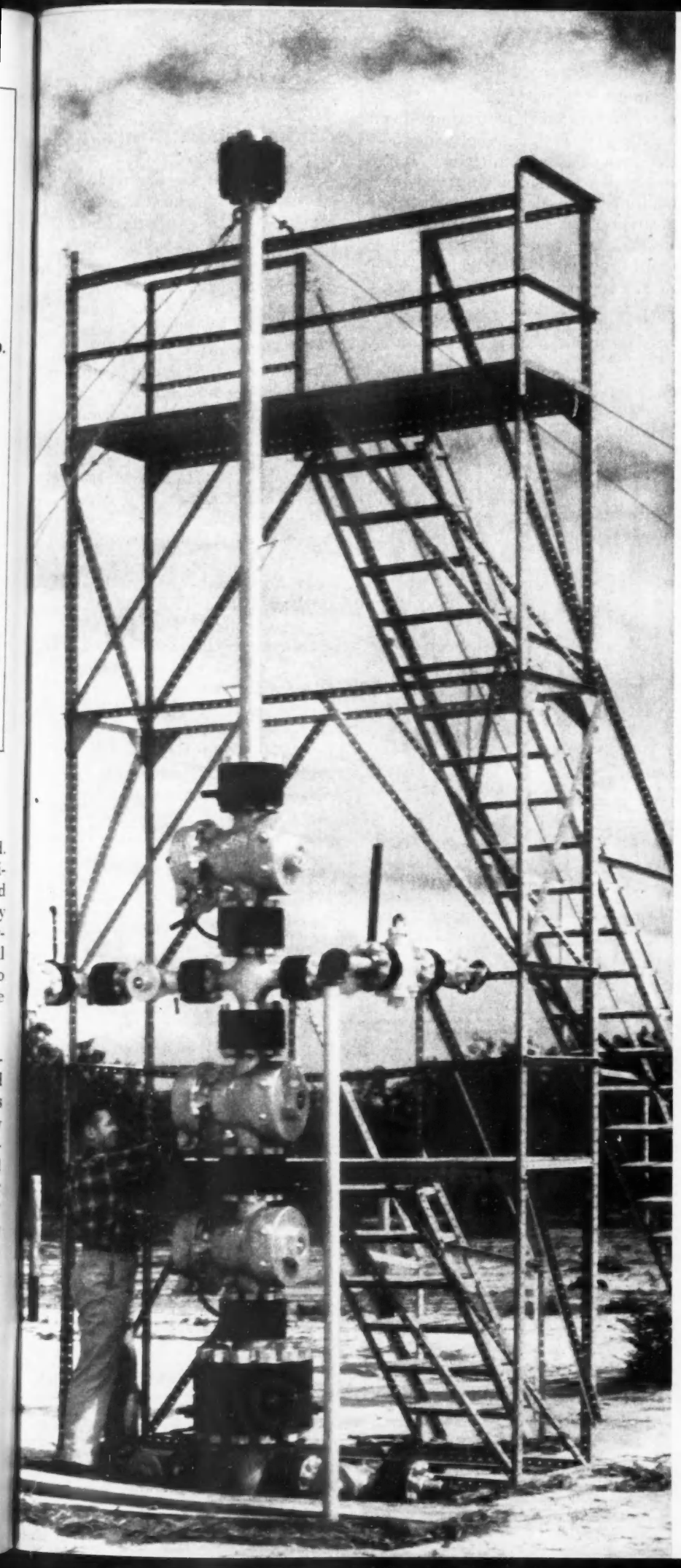
In the majority of wells, one or two drill stem tests are run in order to check the gas/oil contact. They have not always proved conclusive, when natural or oil emulsion muds were used, but are more satisfactory if oil base type mud is used. These types of mud have been used: natural, clay base, oil emulsion, and oil base, and all can easily be kept in good condition. Provided normal precautions are taken, the danger of blowouts is very small.

Occasional lost circulation is encountered when drilling surface hole, but is not difficult to overcome. Approximately two to three 9-inch bits are used. For perforating the casing, either jets or bullets are used since no appreciable difference has been noted. A string of 2½-inch tubing usually is run. Most wells completed in the chert zone will flow, but sand zone wells are always put on pump using conventional equipment.

Waxing is one of the main problems, but this is overcome by the use of scraper rods in pumping wells. The majority of wells give no water cut in production but, in a few wells, water cuts up to 30 percent are encountered. The salt concentration is approximately 15,000 parts per million, and the production water is satisfactorily dealt with by treaters. However, during winter, even a low water cut will cause freezing, especially at valves, so that extensive winterizing of surface equipment has been necessary.

Hydratable clay problem. The majority of wells in the field were drilled with oil emulsion mud, but it is thought that even with a very low water loss a certain amount of permanent damage to the Viking sand zone results. This is caused by the high percentage of hydratable clay contained in the sand which swells up on contact with the mud filtrate and effectively blocks the pore spaces surrounding the well bore.

The chert zone is not affected to the same extent. Recently, two methods of overcoming this problem have been employed. The first is to change over to oil base type mud prior to drilling into the sand, and the second is to use normal clay base mud and,



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after running production string, giving a relatively high volume sandfrac treatment (40,000 pounds sand). It is too soon to judge the relative merits of the two methods.

At present, all oil produced is collected by truck from the batteries and taken to railhead, where it is transported to Regina refineries by tank car. During wet weather, and the spring thaw, roads have been an acute problem, but present extensive gravelling has solved this problem.

Reference to Figure 1 shows that the Smiley field is situated approximately in the middle of the large bar extending for a distance of some 50 miles in an east-west direction. It is possible that further oil traps may be found anywhere along this bar where the structural position is low enough. This has been demonstrated by the recent discovery of Viking oil at Eureka, approximately 15 miles east of the Smiley field.

REFERENCE

[1] Canadian Institute of Mining and Metallurgical Bulletin, September, 1954.

—The End

About the Authors

A. D. HUNT was born and educated in England. After he received his B.Sc. degree from Imperial College, London University, in 1947, with honors in geology, he spent four years in Ecuador with Anglo Ecuadorian Oilfields Ltd. and Manabi Exploration Company, where he conducted subsurface and development geology studies in addition to mapping large areas of coastal Ecuador. Hunt has been in Canada with Canada Southern Oils Ltd. for two and a half years, headquartered primarily in Saskatchewan and northeast British Columbia.

•

Also born and educated in England, M. K. TAYLOR was graduated from Kings College, University of London, in 1943 with a B.S. degree and honors in physics and mathematics. He spent four years with the Shell Group as exploitation engineer in Holland and Venezuela, including a special course in geology and oil technology at the Royal School of Mines, London. Since going to Canada a year and a half ago, Taylor has been associated with Amurex Oil Development Company and Canada Southern Oils Ltd., working mainly in Alberta and Saskatchewan on reservoir problems.

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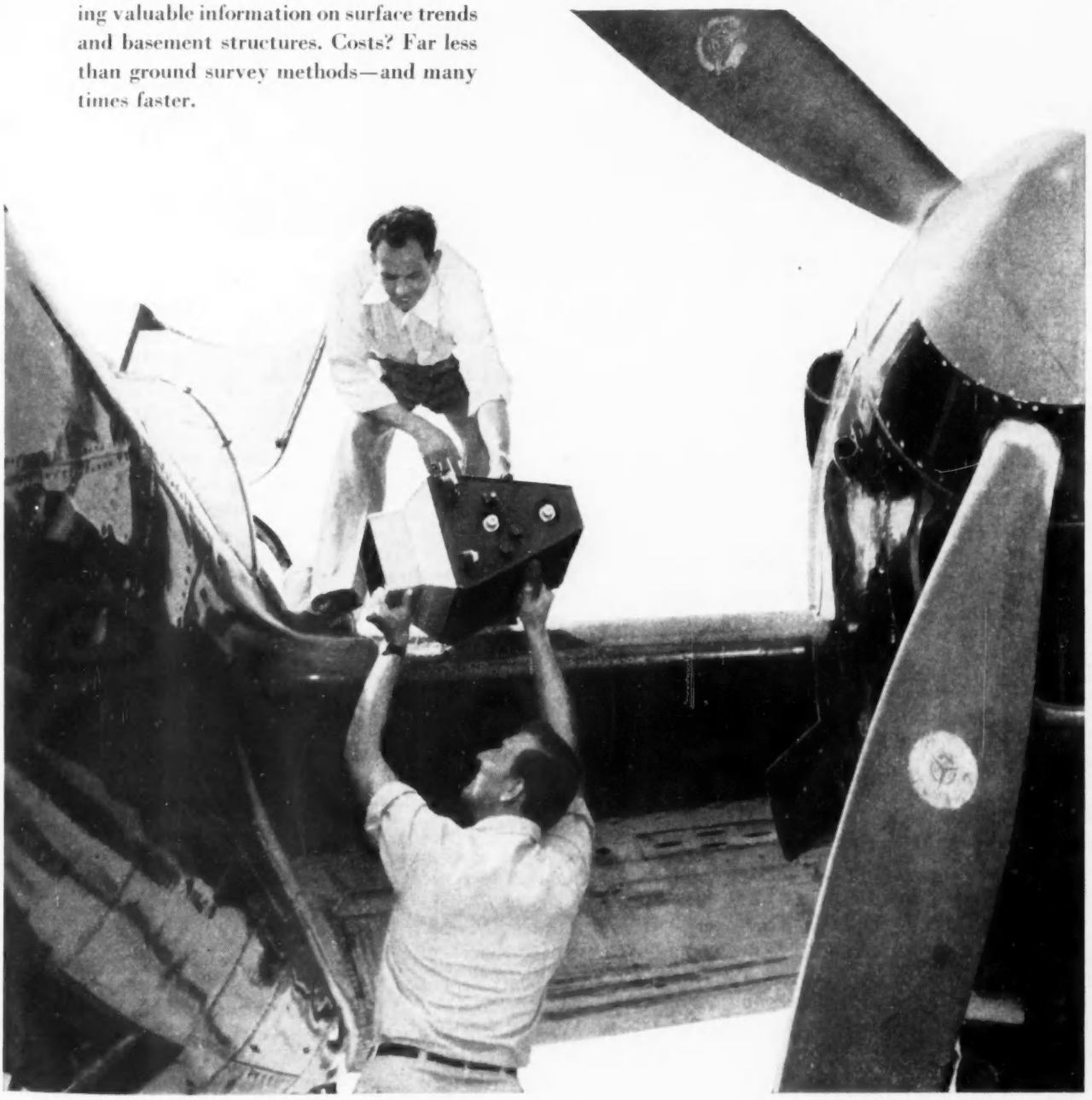

What's Happening

AMONG WORLD OIL MEN

Visitors at New York NOMADS Meeting

Visitors at a recent New York Chapter of Nomads meeting included, standing left to right, Michelle Tripier, The Texas Company, Dakar, Africa; George Knight, Eastern Gulf Oil Company, England; L. P. Hulin, Hayward Tyler & Company, England; S. J. Philippides, Chicago Pneumatic Tool Company, Lima, Peru; D. A. Ingalls, International General Electric S. A., Colombia; and L. E. Birdsong, Mene Grande Oil Company, Venezuela.

Seated are, left to right, Hugh Thompson, California-Texas Oil Company, California; Walter Koehler, Arabian American Oil Company, Lebanon; Jim Noel, Arabian American Oil Company, Saudi Arabia; Y. T. Gulez, Colombia Petroleum Company, Colombia; and Ian Goldie, Masons & Company, Trinidad, B.W.I.

L. K. KING, Ponca City, Okla., supervisor in Continental Oil Company's geophysical section, has been appointed assistant chief geophysicist for the Egyptian-American Oil Company. Also, ROBERT H. GREENWOOD, Ponca City, was named assistant controller of Egyptian-American Oil Company, and W. D. FRANCISCO, Casper, Wyo., was appointed chief technician in Egyptian-American's mine disposal section.

All three will make their new headquarters in Cairo, Egypt.

Egyptian-American Oil Company, a subsidiary of Continental Oil Company, is now exploring for oil in Egypt in a 75,000-square-mile concession about the size of the State of Oklahoma.

King joined Conoco in 1937 as a member of a geophysical crew in Kansas. He later served with geophysical crews in Mississippi and New Mexico before transferring to Ponca City in 1948.

Greenwood became associated with Conoco in Ponca City in 1950 as a staff assistant in the Controller's department. He was promoted to staff accountant the following year.

Francisco was a driller with another oil company before joining Conoco in 1942 as a helper on a seismograph crew in Oklahoma. He served as a driller for Conoco in Oklahoma for eight years before transferring to Wyoming as a senior driller early this year.

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NACY W. McGEE has been transferred to Regina, Saskatchewan, and promoted to chief geophysicist, Canada, for Sohio Petroleum Company.

H. J. Estes

Zeb Mayhew

H. J. (JACK) ESTES, drilling supervisor, geophysical, Basrah Petroleum Company, Ltd., Basrah, Iraq, is visiting in the U. S. on a six-month vacation. He has been employed in the Middle East since 1945. Enroute to the U. S. from Iraq, Estes visited Iraq Petroleum Company, Ltd., headquarters in London and friends in the United Kingdom. He also spent two weeks on the Isle of Majorca in the Mediterranean Sea on his way to the U. S. During his vacation, which ended in November, Estes visited in West Texas, Montana and New York.

•

ZEB MAYHEW, who joined the Standard Oil Company (New Jersey) organization in 1937 as a helper on a drilling rig, has been appointed deputy coordinator of all producing activities of the company.

A native of New Orleans, La., Mayhew went with Humble Oil & Refining Company in 1937 shortly after his graduation from Princeton University with a bachelor's degree in geology. From 1939 until 1953, he was with Creole Petroleum Corporation, first as a geologist and later as district superintendent of the fields at Cumarebo and at La Salina in Venezuela. Mayhew came to Jersey Standard's Producing Coordination department in New York in 1953 as a regional executive concerned with Latin American matters.

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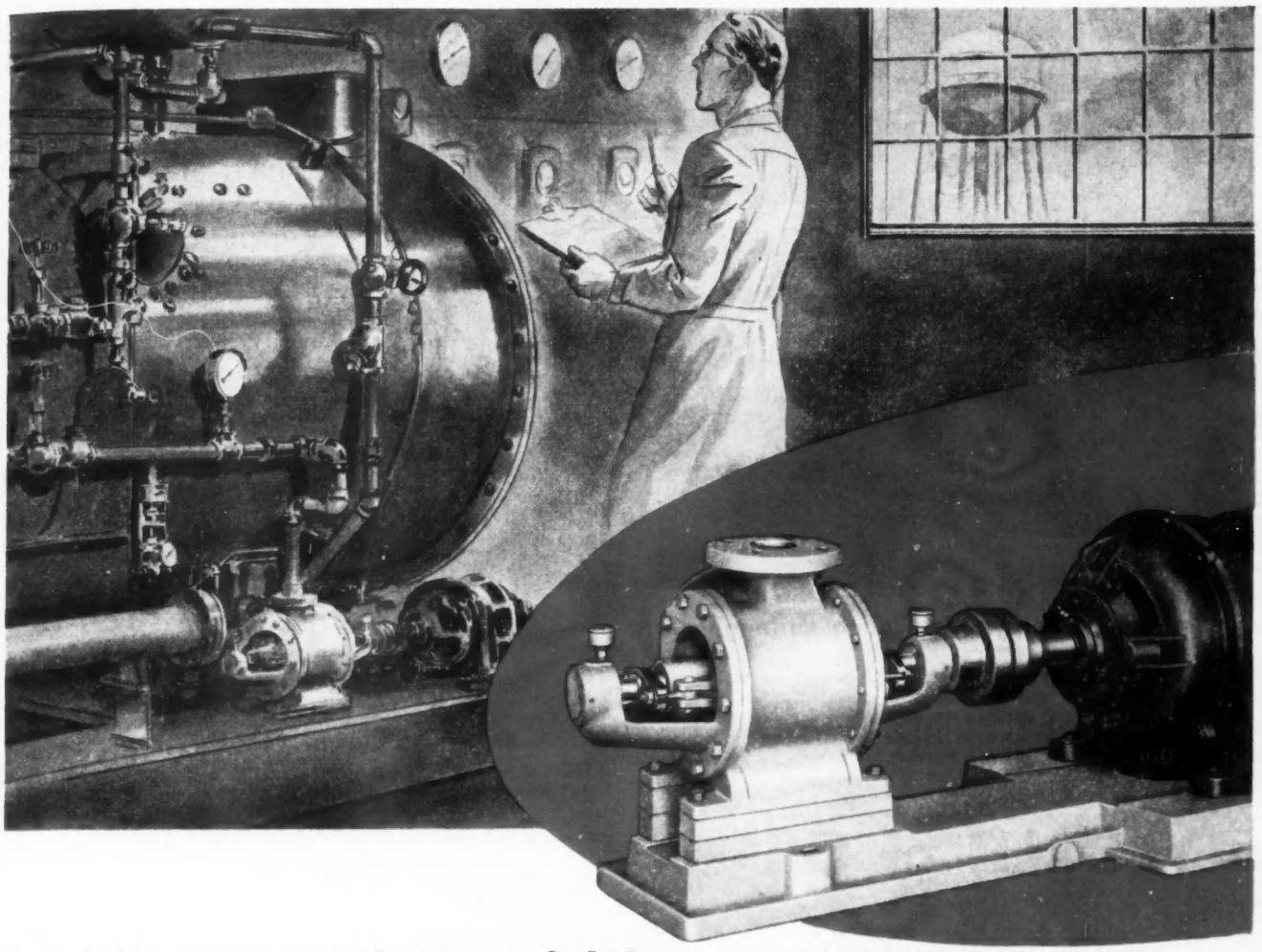
J. H. BERRY, formerly managing director of the Canadian division of the Continental Supply Company, has been appointed managing director of the Devon Drilling Company, Ltd., a subsidiary of Ponder Oils, Ltd., Canada.



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Equipment Begins Trip to Cuban Drilling Site

This is part of a $450,000 mass shipment of a complete drilling rig, loaded on 13 flatcars, now enroute to Cuba where it will be used to launch a wildcat drilling program. The entire shipment was scheduled to travel to West Palm Beach, Havana, and to within 300 yards of the drilling site in central Cuba without unloading. With equipment to sustain operations for two years, the rig will begin exploration operations for Jones Brothers, Inc., on a 17 million-acre tract for Trans-Cuba Oil Company, S. A.

a WORLD of OIL

By DON KLIEWER, World Oil Staff

East Germany: The Pankow Government has ordered increased drilling and geological operations . . . A former gas well at Erfurt is yielding 14 barrels a day of crude at 6561 feet, after it was deepened to that depth from the 5249-foot gas producing horizon . . . Zechdorf well, Ettersberg 1, now is producing 84 barrels of oil daily from 6233 feet . . . Two wells drilled at Salzwedel reportedly are producing 212 barrels each.

Hungary: Communists hope to produce 8.5 million barrels of crude this year, or more than double the amount reached in 1949 before the present Five Year Plan began. The all-time high was in 1944, when Germans produced almost 6.5 million barrels from Hungarian fields.

Russia: Communists claim that an oil deposit was discovered recently in the Volga River valley, near Stalingrad. Reportedly, a new industrial center is being built there, with "dozens" of producing wells in operation . . . Statistical Office says 10 percent more crude was produced during the first half of 1954 than during the same period a year ago . . . Some Western continental sources believe Russia's 1954 crude yield may reach between 414 million barrels and 421 million barrels, with 1955 production possibly reaching to 457 million barrels. The original Five Year Plan demanded production of 508 million barrels for 1955.

Yugoslavia: About 120,000 barrels of oil were produced in June from Mramor Brdo, Ivanicgrad, Bunjane, and Velika Gorica fields, and the nation's crude yield is expected to jump sharply since wells are being completed every week, it is reported . . . During the first half of the year, more than 80,000 feet of hole was drilled.

Mexico: Pemex has bought a new Swedish tanker for $41,125,000 which has a capacity greater than any other tanker in the Pemex fleet to replace the Tampico, which was scheduled to be withdrawn from service . . . After a drop last year, crude production has risen to 41,448,275 barrels for the first half of the year, it has been announced, as compared with 35,750,612 barrels for similar period in 1953.

Iraq: Iraq Petroleum Company has completed the laying of 12-inch pipe line from K. 2 station (Baiji) to the new Iraq Government Oil Refinery at Dora, Baghdad—a distance of 132 miles . . . A multi-channel VHF communications network, with automatic dialing and teleprinter facilities, has been put into use at Basrah by Basrah Petroleum Company. The system links the administration and maintenance headquarters there with the Zubair oil fields on one side and tanker loading terminal at Fao on the other.

Pakistan: Sui 4 was completed with 7-inch casing at 4850 feet and production tests in the transition zone produced gas, water, condensate and water—but no oil; so the well has been plugged back and is being perforated in the main gas zone . . . Sui 5 was drilling ahead at 3200 feet on the north flank of the structure . . . Six-inch casing was set on Chakwal B-10 at 7969 feet in limestone and, after drilling ahead 100 feet, a drill-stem test gave reasonable indication of inflow of oil. Acidized at this depth, the well is undergoing further testing; at present, it is capable of producing more than 100 barrels daily of green oil with some formation water.

India: The Punjab Government is understood to have received a request from Standard Vacuum Oil Company for permission to study the state's oil potential. The company already is conducting geological surveys in West Bengal, Assam and Tripura.

Czechoslovakia: Rationed motor oil may be bought only after presenting car title and registration papers.

New German Wildcat Finds Oil at 2000 Feet

The exploratory well Pattensen 2, drilled by Wintershall AG, near Grasdorf (southeast of Hanover) on behalf of the joint interest Elwerath-Vacuum-Wintershall, has struck oil in the Cornbrash at a depth of about 2000 feet.

This well, which is about one mile from the southernmost well of the Kronsberg field, has proved that the deposit discovered at Kronsberg extends farther southeast. Flow tests yielded about 45 barrels of crude a day; however, it is expected that the well will soon go on the pump.

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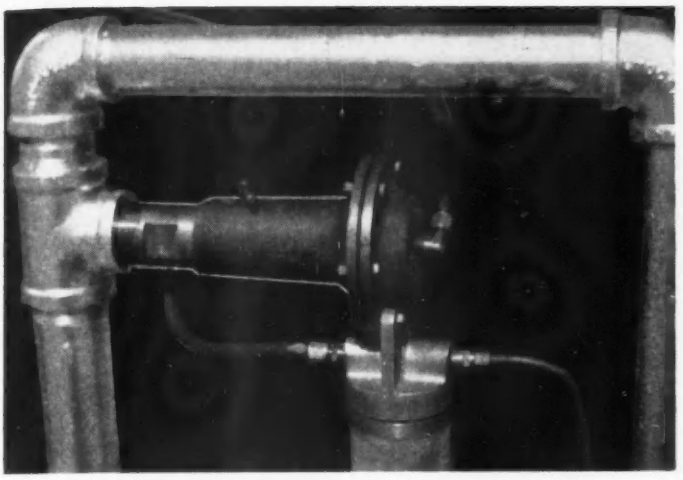

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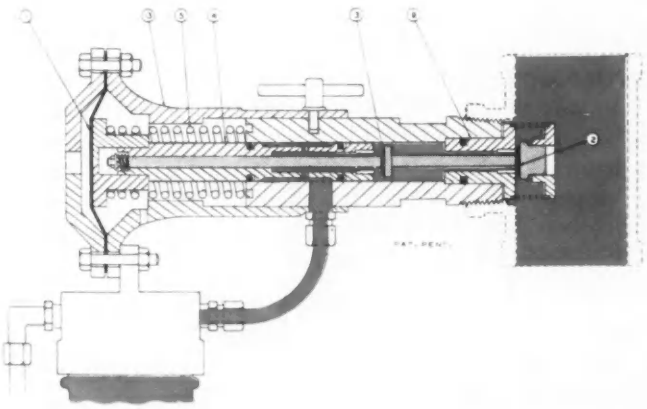

Diaphragm (1) actuates plunger (4) which closes against valve (3) to close discharge line. Plunger movement opens sample valve (2) and pushes displacement piston (9) into flow stream to take sample. As pressure is bled off diaphragm, tension of spring (5) reverses travel of plunger (4), closing valve (2) and opening discharge valve (3). Line pressure forces displacement piston (9) to discharge sample into jar.

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The diaphragm operated Rolo Sampler uses an entirely new principle, and has a minimum of moving parts. The Sampler efficiently operates by any existing snap action pilot on the separator, or an auxiliary pilot may be used to supply liquid, gas or any mixture under pressure of 15 psi or more to the diaphragm chamber.

REMOTE COUNTERS FOR ROLOCHECK METERS—Remote counters may be supplied to record by electricity from a short distance up to about 1000 miles. This telemetering system operates on 110, 220 or 440 volts, AC or DC, or impulse from the meter can be relayed with DC current over telephone wire as small as No. 26, without using batteries. The totally enclosed mercury switch attached to the ROLOCHECK is both explosion and corrosion proof, and transmission and receiving systems are protected against outside interference. Printers recording production are also available.

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Arrangements Completed For 1958 U. K. Exhibition

Announcement has been made that arrangements are complete for the holding in the United Kingdom for the first time a joint exhibition of chemical plant and petroleum equipment. This exhibition will be known as The Chemical and Petroleum Exhibition. It will be held at the Grand Hall, Olympia, London, in June, 1958.

To be organized by F. W. Bridges & Sons, Ltd., the exhibition will be sponsored jointly by the British Chemical Plant Manufacturers Association and the Council of British Manufacturers of Petroleum Equipment.

Communists Claim Need For Sicily 'Protection'

After the resolution approved by the Christian Democratic party at the Sicilian Regional Parliament requesting the Italian Central Government to take steps to place oil and gas research and development in Sicily under control of the Italian State Oil and Gas Monopoly, approval was granted a similar resolution by Communist party representatives at the Regional Parliament.

In the resolution which the Communists supported, the necessity of "protecting" Sicilian oil activities from intervention on the part of foreign groups, including D'Arcy Exploration Company and Gulf Oil Company, was emphasized.

Sicilian Regional Government's Industry and Commerce Department Chief Bianco emphasized that Sicily's mining legislation makes no discrimination between Italian and foreign oil interests. He added that, until now, nothing has been said about drilling operations by foreign oil companies.

Bianco added that the Italian Central Government has gone even further by admitting that the State Monopoly was limited to the Po valley and that private initiative was free to develop activity elsewhere.

Bianco confirmed that three wells which have been drilled in the Ragusa district are producing more than 2000 barrels of crude daily. In the Catania district, seven gas wells also are producing.

An oil structure has been discovered in the Vittoria district, but it is too heavy to be produced without normal pumping equipment. However, a study now is being made as to the advisability of heating the well's side.

Also confirmed by Bianco is the issuance of a development concession for Ragusa field, where ten additional wells are scheduled to be completed in 1955.

Austrian Industry Trend Is Toward Oil

Exceedingly low prices for Austrian fuel oil have influenced many changes from coal to oil consumption in larger industrial enterprises. The level of the nation's domestic requirements, therefore reached an all-time high during the middle of 1954, permitting a 1954 total consumption of about 5 million barrels of oil.

The Soviet Mineral Oil Administration, however, supplies only about 4 million barrels to Austria, forcing the Austrian economy to import the difference for 1954. Imported fuel oil is almost 30 percent higher in price so advantages of using oil are lost.

Vienna oil firms hope to get SMOA to agree on higher deliveries. At the same time, responsible Austrian authorities are discussing measures for a reduction of duties on fuel oil imports.

Deep Test Drilling Ahead Near Jerusalem

Deep drilling is under way 17 miles southwest of Jerusalem by Israel-Mediterranean Petroleum Company and Pan-Israel Oil Company, U. S.-backed companies holding licenses covering approximately 800,000 acres in Israel.

The test, Tell-Es-Safi, 1, is scheduled to be drilled to 8000 feet in an effort to find production in the Cretaceous and Jurassic formations, both of which are prolific crude producing formations elsewhere in the Middle East.

More than a year of geological and geophysical operations were conducted in the area prior to moving the U.S.-built rotary onto the location. About 20,000 feet of structural drill holes were included in the previous testing period.

Pantepec Oil Company, C. A., a Venezuelan firm operating in Israel through its wholly-owned subsidiary, Tri-Continent Drilling Company, is the drilling contractor for Tell-Es-Safi 1. Pantepec's contracts with the two companies call for extensive core hole drilling as well as the drilling of at least six deep tests.

Deep Drilling Trend In Germany Is Rising

The number of deep drilling rigs used in the search for oil and natural gas in West Germany is increasing. Registered in drilling statistics for August, recently tabulated, are 144 deep wells which had either been completed or were still drilling at the month's end.

Total of footage drilled reached a new record with 220,000 feet. While footage had been particularly high in exploratory wells in June and July, the normal preponderance of the drilling activities in already proven sections of oil fields was again restored in August, with a total of 117,120 feet. Twenty-six wells were successful in the month, including extension wells Ploen 13 and Bramstedt 4 and the gas well Stockstadt 105.

August's deep well footage was supplemented by 1815 feet in shallow wells drilled exclusively for test purposes on the Upper Rhine (Appenweier and Schliengen).

Footage Drilled in August

Type	Feet
Exploratory wells	58,693
Extension wells	38,310
Production wells	117,120
Service wells	5,877
	220,000

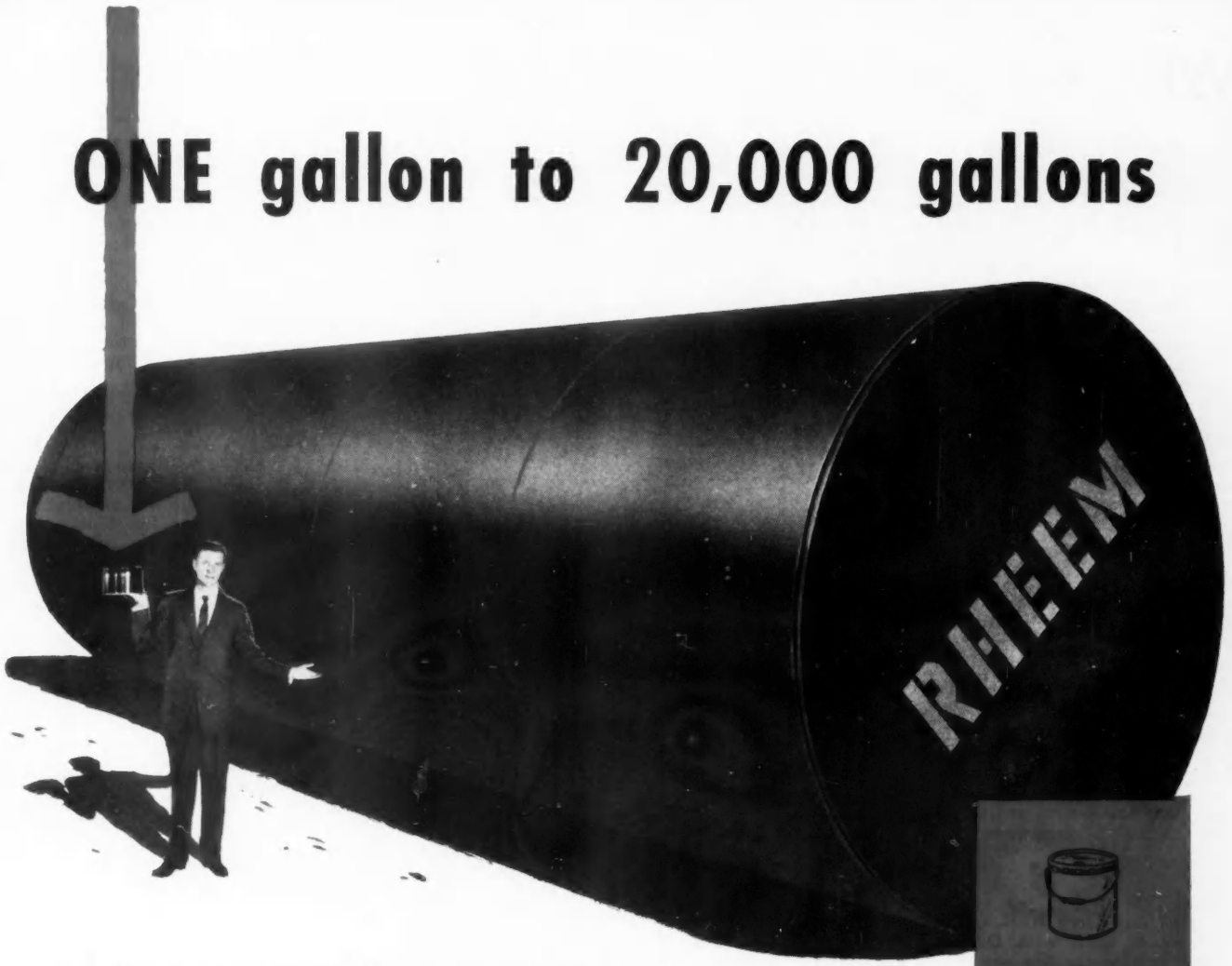
D'Arcy Studying Oil Structure in Sicily

D'Arcy Exploration Company has begun studying the oil structure discovered in Sicily's Vittoria zone at a depth of 6561 feet and with a width of 984-1640 feet. D'Arcy is negotiating with the Italian State Gas and Petroleum Monopoly on the possibility of AGIP-Mineraria Company undertaking the drilling of a test in the Ragusa zone.

In this connection, the Italian Parliament has approved a resolution urging the Government to expand activity of the state-controlled industrial concerns. That includes Ente Nazionale Idrocarburi, which has monopolized oil and gas research and development in the Po valley.

The resolution was offered by the Christian Democratic Labor Organizations.

ONE gallon to 20,000 gallons



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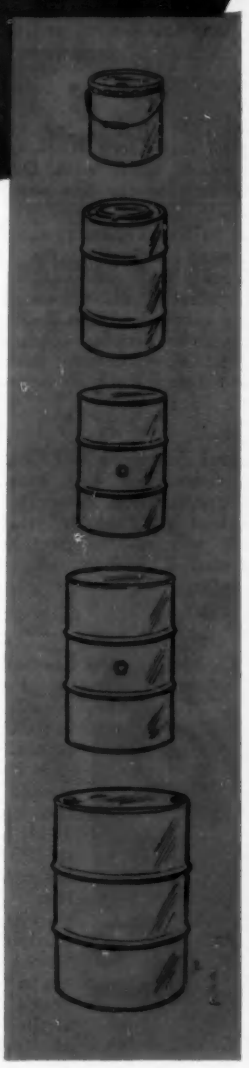

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What's Happening

AMONG MEN IN THE INDUSTRY

John Sloat, formerly manager of exploration for Pacific Coast division of **Union Oil Company,** has been appointed to the administrative staff of the company's western area Exploration department which covers the Pacific Coast, Rocky Mountain, Canadian divisions and unassigned areas. **Charles F. Manlove** and **Edward W. Scott** also have been appointed to the administrative staff. Other changes in the Exploration department include **John E. Kilkenny,** appointed chief geologist of Pacific Coast division, and **Fred W. Bush,** formerly manager of exploration for Williston Basin division, appointed manager of lands for the Pacific Coast division and unassigned areas. The Williston Basin division has been consolidated with the Rocky Mountain division with headquarters at Denver under **W. E. Morgan,** manager of operations, Rocky Mountain division.

•

J. B. Lassiter, Jr. has joined the staff of **Lion Oil Company's** Reservoir Engineering department in El Dorado. Lassiter will be senior engineer in the reserve and economics section. Prior to joining Lion, Lassiter was for several years chief engineer of Marine Oil Company in El Dorado.

•

William F. Styler, Jr., has been named controller of **Deep Rock Oil Corporation.** Styler has been with Deep Rock since 1949, serving for the past three years as assistant to the president. He will continue in this capacity, along with his new duties as controller. As assistant to the president, he will continue in charge of all special deals involving Deep Rock. Styler succeeds **Allyn R. Bell, Jr.,** who has resigned to become controller of General Crude Oil Company in Houston. Bell joined Deep Rock in September, 1948.

•

General American Oil Company of Texas has announced two executive changes. **Gordon Simpson,** formerly executive vice president and head of the Legal department, was named president to succeed **Malcolm E. Wilson,** elected chairman of the board.

•

W. C. McCammon has been appointed to the newly-created post of assistant to the president of **Standard Oil Company of California.** McCammon, who has served as assistant comptroller of the company since 1944, joined Standard in 1932 and has spent his entire business career with the company. McCammon graduated from the University of California in 1930 and took a year's graduate study at the Harvard School of Business Administration.

W. C. McCammon

J. M. B. Howard

John D. Rogers

John D. Rogers, a director and vice president of **Esso Shipping Company,** has been elected executive vice president and **John M. B. Howard** has been elected a director and also vice president. Esso Shipping Company is an affiliate of Standard Oil Company (New Jersey). Rogers has been with the Jersey organization for 38 years; Howard for 21 years. Rogers joined what was then known as the company's Marine department in 1916, and from 1918 to 1932 he was first a ship operator and then assistant chief of the operations section. In 1932 he became chief of the operations section; in 1936 he was named assistant manager of the operating division and he became manager of that division in 1943.

He subsequently held executive positions overseas in the Panama Canal Zone area and served as joint general manager of Esso Transportation Company, Limited, in London. In 1948 Rogers returned to New York to become assistant general manager of the Marine department. When the Esso Shipping Company was organized in 1950, Rogers was elected a director and vice president. Howard, a graduate of the United States Naval Academy, started as a deck officer on company tankers in 1933, later receiving his master's papers. After executive service in shore posts at New York, Baltimore, Baton Rouge, Houston, Caripito, Venezuela, and Aruba, N. W. I., he became assistant general manager of the Esso Transportation Company in London. From this post in 1948 Howard went with another Jersey Standard affiliate as assistant manager of Standard-Vacuum Oil Company's Marine department. In 1950 he was named general manager of that department, the post he held prior to his new position.

•

W. M. Paggi has been promoted to regional superintendent, Operating department at Houston for **Sun Oil Company.** Paggi formerly was assistant superintendent at Houston. He succeeds **J. O. McPherson,** who retired recently after more than 45 years of company service. In his new position Paggi will supervise Sun drilling and producing operations in all operating department areas west of the Trinity River in Sun's Gulf Coast division. Paggi has been a member of the Sun organization for more than 21 years, serving in various capacities throughout the Gulf Coast division in Texas and Louisiana.

Ben H. Anderson has been named manager of drilling and production for **Oceanic Oil Company.** Anderson has been associated with Continental Oil Company for the past 20 years. During the last 5½ years he was regional manager of production, western region, including production operations in the state of California and exploratory drilling in Nevada.

•

Millard F. Westfall has been promoted to acting production superintendent for **Husky Oil Company.** Westfall was assistant production superintendent for Husky since 1952. Westfall's promotion followed the transfer of **John R. Yoder** to Israel. Yoder is in Beersheba in charge of drilling operations for Israel-American Oil Corporation. Before joining Husky, Westfall was district engineer for Cities Service Oil Company, Texas District, Graham, Texas.

•

Arrow Drilling Company has announced the appointment of **D. L. Edmiston** as president of the company succeeding **I. H. Patton, Jr.,** deceased. Edmiston is a long time employe of Arrow, having joined the organization in June 1932. Prior to his appointment to the presidency, Edmiston was vice president in charge of production and drilling.

•

Warren Petroleum Corporation has announced three promotions in the Geological department. **Morris H. (Benny) Benson,** district geologist in the Tulsa office, has been transferred to Midland, Texas, to be district geologist for the West Texas area. **Kenneth Keene,** who has been on the geological staff at Midland, has been promoted to district geologist for the New Mexico area. He will continue to have headquarters in Midland. **R. A. Hobbs** has been transferred from Abilene, Texas, to Tulsa to become district geologist for Oklahoma.

•

E. L. (Dick) Anders, Jr., has resigned as chief engineer for the SACROC Unit to enter business for himself as a consultant.

E. L. Anders, Jr.

A graduate of the University of Texas in 1940 with a B.S. degree in petroleum engineering, Anders was granted a M.S. degree in petroleum engineering by Colorado School of Mines in 1950. From 1946 until 1948, he was a reservoir engineer for Creole Petroleum Corporation at Caracas, Venezuela, at the end of which time he was employed as associate professor of petroleum engineering at the University of Kansas. He taught for three years and was made chief reservoir engineer for the International Petro-

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-AN' YO'!!
-AN' YO'!!

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KILGORE
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Tuboscope 2-3831, 4-1327
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leum Co., Ltd., Talara, Peru, which job he held until his appointment in July, 1953, as chief engineer for SACROC. His new address is the Windsor Hotel, Abilene, Texas.

•

Marvin N. Chamberlain, Ponca City, Okla., has been elected assistant treasurer of **Continental Oil Company** with headquarters in Houston. Formerly he was supervisor of internal auditors in the Controller's department at Ponca City. **M. E. Elliott,** Ponca City internal auditor, will succeed Chamberlain as supervisor of internal auditors. Chamberlain joined Conoco in 1935 and Elliott has been associated with the company since 1937.

•

F. Hugh Wilson has been named division geologist by **Tide Water Associated Oil Company** to direct geological activities in the company's Southern division, which covers the Gulf Coast area from Florida to Brownsville. **K. A. Schmidt,** who has been acting division geologist since last May, will be placed in charge of Tide Water's offshore geological work. Wilson started to work for Tide Water in 1940 in the company's Evansville office immediately after his graduation from Missouri School of Mines where he majored in mining engineering and geology. After five years in military service, Wilson rejoined Tide Water in 1946 as a geologist in the Jackson, Miss., office. He was district geologist there in 1951, when he was transferred in the same capacity to the company's Lafayette, La., headquarters. In 1952 he was promoted to regional geologist and transferred to Houston.

F. H. Wilson

•

Victor V. Horner, Denver, has been named a research engineer in the drilling methods section of **The Carter Oil Company** research laboratory. Horner was graduated from the University of Tulsa with a B.S. in petroleum engineering in 1935. He first joined Carter shortly after his graduation as a member of an inventory crew and advanced to district petroleum engineer in Powell, Wyo., the position he held until 1945. For the past nine years he has served as division engineer and secretary-treasurer for two major petroleum firms.

V. V. Horner

•

Al Saterdal, formerly district geologist for **The Texas Company,** Casper, Wyo., has joined the staff of **Wm. Ross Cabeen and Associates,** Denver. **Charles Lydon,** formerly geologist with Eagle-Picher at Grand Junction, has opened an office for Wm. Ross Cabeen and Associates at 147 Hall Avenue, Grand Junction, Colo. Wm. Ross Cabeen and Associates engages in exploration for oil and uranium.

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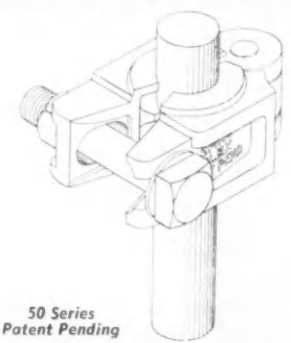

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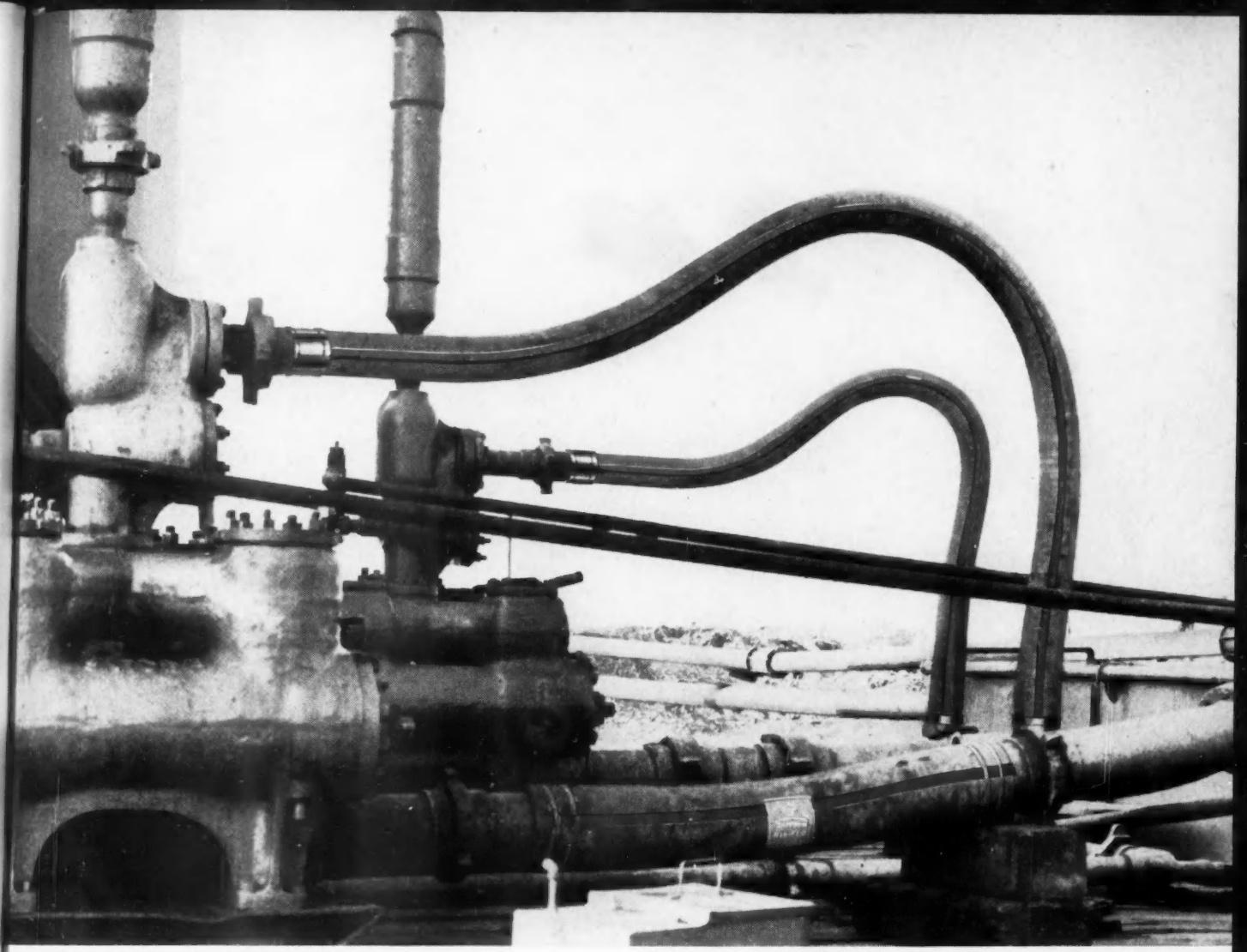

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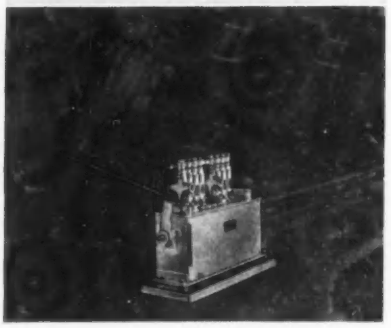

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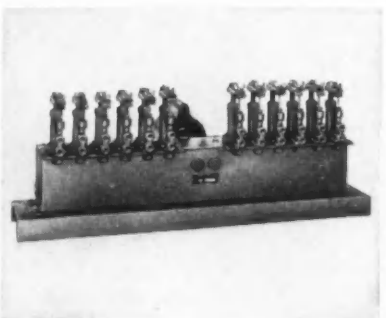

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E. W. Dissler

Z. E. Stucky

E. W. Dissler, manager of exploration for **Canada-Cities Service Petroleum Corporation** at Calgary, Canada, is being transferred to Bartlesville as assistant chief geologist for **Cities Service Oil Company. Z. E. Stucky** of Bartlesville, assistant to the chief geologist, is being transferred to Calgary as manager of exploration for Canada-Cities Service Company. Dissler has been with Cities Service since 1940 and was marine geophysicist for Cities Service Oil at Houston before his appointment as exploration manager for Canada-Cities Service. Stucky joined Cities Service in 1928 and was division geologist for Cities Service Oil until last year when he was named assistant to the chief geologist.

•

Lucien F. Craig has been appointed Washington (D. C.) representative for **Gulf Oil Corporation** and its subsidiaries. He will be a member of the company's Executive department.

•

William B. Macey, chief engineer of the **New Mexico Oil Conservation Commission**, has been named state geologist and director of the New Mexico Oil Conservation Commission. Macey replaces **Richard R. Spurrier**, who resigned to enter private business after serving in this post since 1945. Macey joined the commission as chief engineer in 1952. Prior to that time he had been district superintendent of American Republics Corporation at Artesia, N. M., for four years.

William B. Macey

•

W. W. Flenniken, Denver oil man, has been named one of two new directors of Braniff International Airways. Flenniken, who has been active in the oil industry 20 years, first was associated with aviation in the early 1930's as station manager, division traffic manager, and pilot for American Airways. Flennigen was with Halliburton Oil Well Cementing Company until 1947, when he was named general manager of Fred E. Manning, Inc., a Denver drilling contracting and oil producing company. In 1951, Flenniken became an independent oil operator. He also maintains a partnership with R. E. Neher, also of Denver, in the oil business.

•

Warren-Bradshaw Exploration Company has announced the transfer of its district office from Abilene to Midland, Texas. The new office will be located in the West Building and will be a division office handling all land and exploration activities for the company in the West Texas, West-

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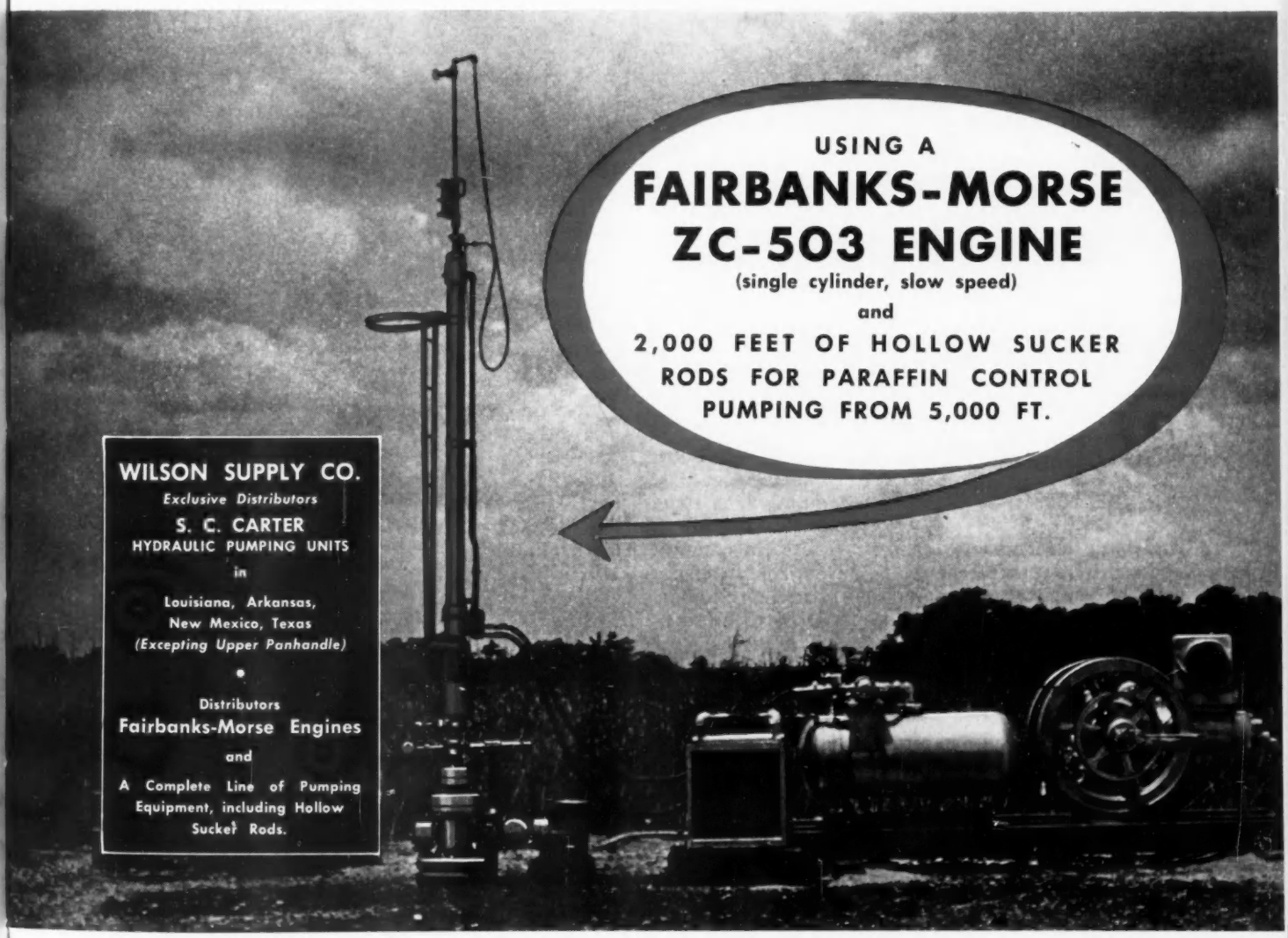

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We have, however, maintained several similarities between the Hercules spark-ignited and the Hercules diesel engines which we think are very important. First of all, gasoline and diesel engines of comparable piston displacement have similar mounting dimensions and operating characteristics. Generally speaking, this makes it possible for equipment to be powered by either Hercules gasoline or diesel engines without creating any major installation problems. Thus, equipment manufacturers are able to supply customers with the proper type of engine to assure "top-notch" economies, according to the customers' operating conditions.

Another similarity between our gasoline and diesel engines, is that they both are of the 4-cycle design. The 4-cycle design is universally accepted and understood. This feature provides for less complicated engine servicing and in addition, service is readily available throughout the country.

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Central Texas and New Mexico areas. The Midland office will be headed by **Thomas M. West,** who has joined the company as division geologist.

•

Bushrod B. Howard, an authority on domestic and foreign tanker operations, has announced his retirement from **Standard Oil Company (New Jersey)** after 34 years with the Jersey organization, nine as a director. Joining Jersey Standard's Marine Operating division in 1920, Howard took over duties of European representative for the shipping company in Paris two years later, becoming managing operator of Societe Auxiliaire de Transports in 1925, and later director of L'Economique Societe Anonyme and Bedford Petroleum Company, affiliates of Jersey Standard. Returning to New York office in 1934, Howard was made assistant manager of the Marine department and in 1939 was appointed general manager of the department, which is now the Esso Shipping Company. In 1943 Howard was elected president of War Emergency Tankers, Inc., an agency formed by some of the major oil companies at the request of the government to provide trained personnel and to operate the government's growing tanker fleet.

Bushrod B. Howard

•

J. B. Dunbar of **Dunbar Drilling Company,** Denver, the newly-elected president of the AAODC, has been named to the National Petroleum Council.

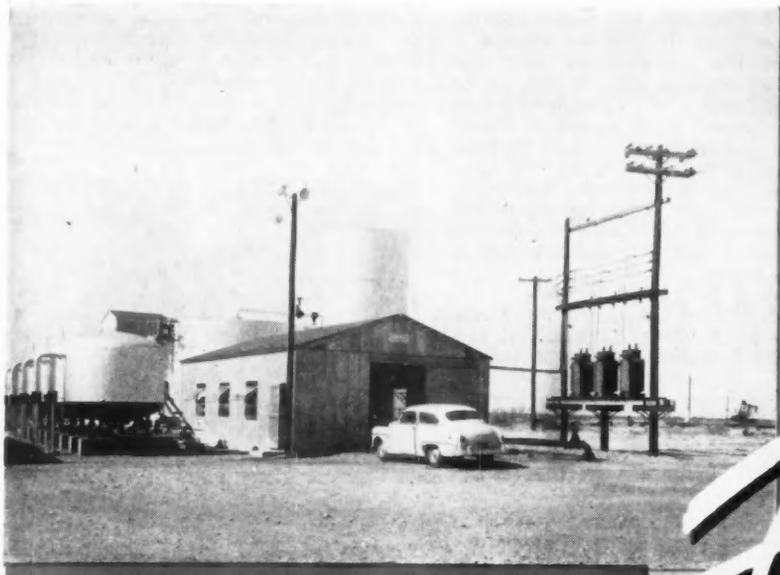
•

Fred M. Keller, president of **Oceanic Oil Company,** has announced the appointment of **Ben H. Anderson** as manager of drilling and production. Anderson, a petroleum engineer, is a graduate of the Colorado School of Mines and has been associated with Continental Oil Company for the past 20 years. During the last 5½ years, he was regional manager of production, Western Region, including production operations in California and exploratory drilling in Nevada.

•

Walter E. Babel, Jr., has become associated with the Law department of **Housh Drilling Company** and other Housh enterprises. A graduate of the University of Texas, Babel received his degree in business administration in 1940 and his law degree in 1942. After service in World War II, he joined the Houston law firm now known as Fulbright-Crooker-Freeman-Bates and Jaworski, where he remained until his recent association with Housh.

Walter E. Babel



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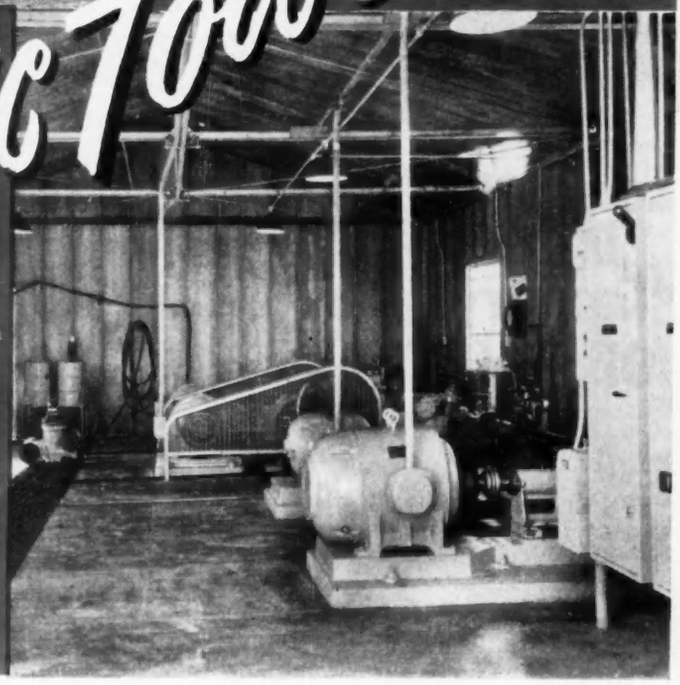

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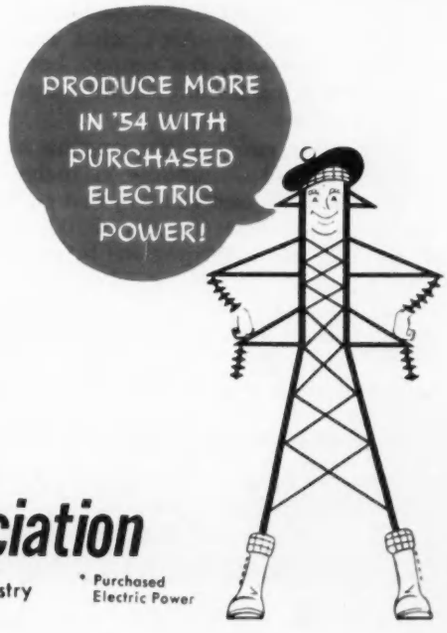
Let Purchased Electric Power go to work for *you!* There's a Power Engineer at your nearest Electric Power Company who can give you the answers to all your power problems. Why not get in touch with him today?



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M. K. Winborn has been elected an assistant trust officer of **Republic National Bank of Dallas.** Formerly he was with the Bank of America, San Francisco, and since 1949 has been in the Trust New Business department of Hartford-Connecticut Trust Company.

•

Arrow Drilling Company has announced the following transfers: **James Parker** returns to Midland, Texas, as manager of the West Texas and New Mexico district; and **Louis Roark,** formerly manager of the West Texas and New Mexico district, is being transferred to Shreveport, La., as assistant area manager of the East Texas-Arkansas-Louisiana-Mississippi area.

Union Oil Company has announced the election of **Elmer H. (Buck) Weaver** as vice president. During the past year Weaver has been on loan to the United States government as assistant director, Office of Defense Mobilization, in charge of critical materials and stockpiling. Prior to leaving for Washington he had been manager of Union's Purchasing department for many years and upon his return was made director of procurement and contracts. Weaver started with Union Oil in 1918 as a buyer.

•

Le Roy H. Hines has joined the investment firm of **J. Barth & Company,** as a consultant on matters relating to the petroleum industry. Hines, an independent petroleum consultant, was formerly vice president of Northern Pacific Railway, in charge of oil development. Prior to that he had been with Standard Oil of California in the Land department and assistant to the vice president.

L. B. McCammon

M. D. King

L. B. McCammon, manager of the Products Distribution department of **The Ohio Oil Company,** will retire December 1 under the company's annuity program. He has completed 24 years service with Ohio Oil. **M. D. King,** assistant manager of the Products Distribution department, will succeed McCammon as manager. McCammon joined The Ohio Oil Company in 1930 when the company acquired the properties of the Transcontinental Oil Company. He was employed by Transcontinental from 1920 to 1930 and was a vice president and director of that company. He had been employed by the Benedum Trees Oil Company from 1915 to 1920. His first assignment with Ohio Oil was vice president of the former Marathon Oil Company. In 1938 he was made manager of Ohio Oil's marketing operations in Oklahoma and Kansas. When the company sold its marketing facilities in the Mid-Continent in 1939, he was transferred to Robinson, Ill., and was appointed manager of the then newly organized Refined Products Supply department. He was transferred to the general office, Findlay, in the same capacity in 1947.

King first worked for Ohio Oil as messenger in the general office in 1926 between school terms at Findlay College. His continuous employment began in February, 1931, as secretary in the Refining and Marketing department, Robinson. In 1935 he was transferred to the general office. He was transferred to Robinson in 1939 and was made assistant manager of the Refined Products Supply department. Recalled to the general office in 1945 he was advanced to assistant to the manager of the Refining and Marketing department. King served in this post until January, 1954, when he was appointed assistant manager of the Products Distribution department.

•

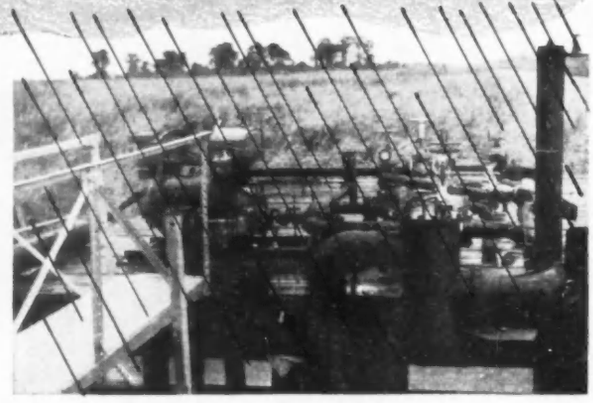
Louis Desjardins, formerly of Houston and more recently with Conselho Nacional de Petroleo in Brazil, has opened a consulting photogeological service in Rio de Janeiro. Associated with him is **Horace B. Cooke** and **G. Nelson Smith.** The firm is called Servicos Fotogeologicos Desjardins (Desjardins Photogeological Services).

•

Humble Oil & Refining Company recently announced the following changes in Production department supervisory personnel. **Joe Kostka,** regular part-time driller on Rig 31 at Goose Creek District, Gulf Coast division, was promoted to regular full-time morning tour rotary driller. **G. D. Mayfield,** rotary driller,

WISCONSIN-POWERED

Gathering Pump Unit Weathers 11-Inch Rain Storm in Louisiana Delta Country Oil Field

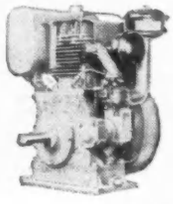


Back in the Louisiana Terrebonne Parish delta country, Wisconsin-powered Gathering Pump Units take a terrific beating from the elements.

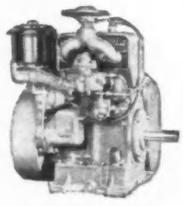
Not long ago two Harley Sales Company service engineers, while making their rounds in this oil field, had occasion to check the platform-mounted installation shown above, on which a Wisconsin Model VG4D Heavy-Duty Air-Cooled Engine was operating with the canopy housing removed, leaving the engine fully exposed to the weather.

Shortly after starting the engine a 70 m.p.h. gale broke, dumping 11 inches of rain while the Wisconsin-powered gathering pump began the transfer of 1000 bbls. of oil. The next morning the tanks were empty and the engine no worse for the ordeal . . . again demonstrating the all-weather dependability of Wisconsin Air-Cooled Engines.

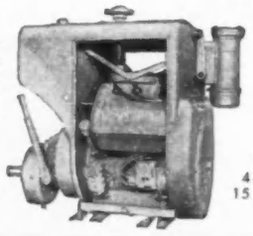
You can't do better than to specify "Wisconsin Engine Power" for your oil field utility units.



4-cycle single cylinder 3 to 9 hp.



2-cylinder models 7 to 15 hp.



V-type 4-cylinder 15 to 36 hp.

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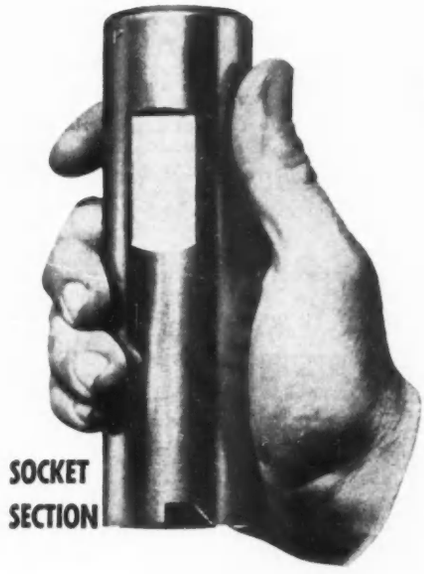
Step up your production operations

with PAGE*

Sucker rod ON and OFF attachment



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2 *EASY RELEASE IN CASE OF SANDED-UP PUMP*

3 *FISH BROKEN RODS WITHOUT PULLING PUMP*

This highly developed PAGE ON AND OFF ATTACHMENT assures quick and easy connection or disconnection of sucker rods at the pump. It provides for easy removal and replacement of sucker rods without disturbing the pump plunger.

To operate, run the pump in on the tubing with the lower end of the PAGE tool in place. Then lower the rods with the matching ends of the tool attached. When the two sections of the ON AND OFF ATTACHMENT meet, turn right and lower to engage. Then a turn to the left will lock the two sections together.

To disconnect, lower the rods, turn right to the radial stop and pick up.

By means of this tool you can run pumps larger than the size of the tubing. Also broken sucker rods can be "fished" without unseating the pump or dumping the fluid.

The tool is rugged and simple in design—no complicated mechanism to offer trouble. Both the spear and socket sections of this PAGE ON AND OFF TOOL are milled with nine extra-heavy lugs to support the load and to assure long life.

Made for all sizes of sucker rods.

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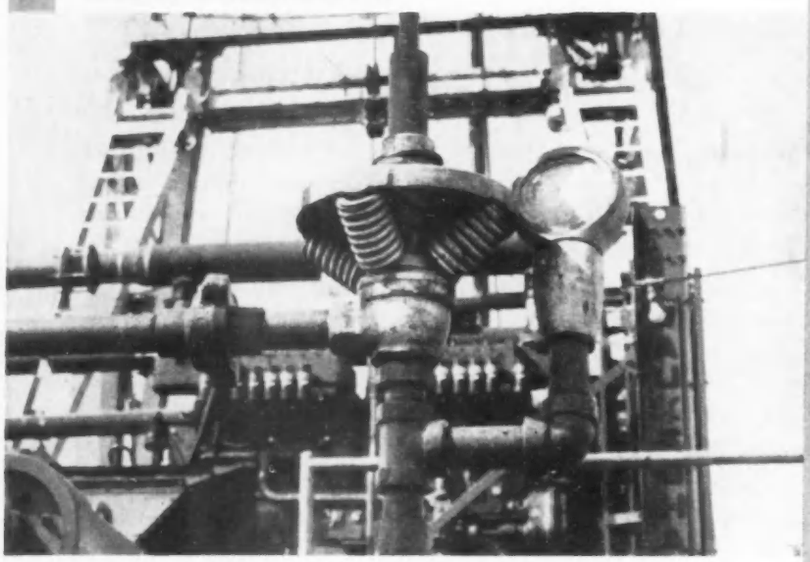

When overloads occur, the Kinzbach Model 112 Valve relieves the system instantly of the overload surge. Line pressure is maintained at a pre-set level, thus reducing the danger of a blowout. And, in case of momentary blockage, circulation is restored immediately, eliminating the danger of suspended cuttings settling and causing stuck pipe.

If the system overloads repeatedly, the 112 Valve will cycle rapidly without chattering and without damage, and without dropping the line pressure below the pre-set level, until the cause of the overload can be removed. Pump surges, which can be as high as 40% over normal pressure, do not affect valve operation so long as the proper valve for the service is selected and the pop-off pressure is properly set.

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Grand Isle district, Louisiana division, was promoted to toolpusher at Grand Isle. **George Dickens**, toolpusher at Greta district, Southwest Texas division, was transferred to the Anahuac district, Gulf Coast division, as toolpusher. **C. J. Wooley, Jr.**, supervising petroleum engineer in the Southwest Texas division office, was transferred to the Petroleum Engineering division, Houston office, as supervising petroleum engineer. He was replaced in Southwest Texas by **D. M. Stewart**, supervising petroleum engineer, Petroleum Engineering division, Houston. **J. G. Jackson**, petroleum engineer in the Southwest Texas division office, was promoted to senior petroleum engineer. **Dandridge W. Marston**, district civil engineer, Kelsey district, Southwest Texas division, was transferred to the East Texas division office as senior civil engineer.

•

M. A. Wright, executive vice president and a director of **The Carter Oil Company**, has been appointed coordinator of all producing activities of **Standard Oil Company (New Jersey)**. He succeeds the late **Roger H. Sherman** as head of the Producing Coordination department. After serving in various engineering positions in Oklahoma and Louisiana for Carter, Wright became its chief petroleum engineer in 1943 and asistant manager of the Production department the following year. Wright received appointments as executive assistant in Jersey Standard's Producing department and was named deputy coordinator of producing operations. He was elected executive vice president of International Petroleum Company, Ltd., also a Jersey affiliate, and in 1952 was elected to his present position with Carter.

M. A. Wright

•

Richard A. Ny of Albany, Calif., has been promoted to divisional treasurer of **Tide Water Associated Oil Company's** Western division. Ny started with Tide Water as a tax clerk in 1938, served as tax accountant for seven years and was promoted to paymaster in 1951.

•

R. M. Dungan, Ventura, Calif., has been appointed division geologist for **Continental Oil Company's** southern region offshore Marine department. He formerly was a division geologist for Conoco at Ventura. Dungan joined Conoco in 1948 as a geologist in California and was promoted in 1952 to division geologist at Ventura. He is a native of Newkirk, Okla., and received his bachelor's degree in 1948 from the University of Oklahoma, where he majored in geology and engineering.

•

Z. C. Ambrose, formerly vice president and general manager of Southwest Gas Producing Co., Inc., Monroe, La., has been appointed assistant president and will assist in directing operations of both the oil and gas of the **Associated Oil Field Rentals** division of **Associated Oil & Gas Company**, Houston.

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DEATHS

Roger H. Sherman, 50, coordinator of producing operations for the Standard Oil Company (N. J.) died at his home in Forest Hills, N. Y. Sherman was a director of Standard Oil Development Company and Arabian American Oil Company.

•

H. L. Hathaway, 61, sales manager for Standard Oil Company of Texas, died in El Paso, September 7. He joined Standard of Texas' parent company, Standard Oil of California, 39 years ago and has been sales manager for Standard of Texas in El Paso for 13 years.

•

William Giffert, 45, Denver oil man and former resident of Tulsa, died September 30 in Tulsa. Before becoming an independent, Giffert was in the Land department of Stanolind Oil and Gas Company at Casper, Wyo.

•

Charles F. Foster of Cushing, Okla., president of the Charles Foster Drilling Company, died September 30. He was formerly in the banking business, becoming interested in the oil business in 1940.

R. K. (Bob) King, 54, formerly manager of the Hunt Tool Company, Corpus Christi division, who had been with Hunt Tool for 18 years, died September 5 in Corpus Christi. King moved to Casper, Wyo., this year to open the K & W Sales and Service Company to represent Hunt Tool in the Rocky Mountain area. He had recently returned to Corpus Christi, Texas.

•

Ellwood J. Munger, founder of America's first oil field scouting service, died October 4 in California. Munger founded the Munger Oil Information Service in 1919 as a weekly publication covering the Los Angeles Basin area and later increased the coverage to the entire state. In 1929 the increased drilling activity and need for more frequent coverage gave rise to the daily report.

•

Arthur G. Denman, 81, died in Sedan, Kansas, October 22. He was associated with his brother, John Denman, Jr., of Independence, Kansas, in the Denman Brothers Oil Company.

•

Thomas Clyde McCobb, 71, a former director of Standard Oil Company (New Jersey) died October 22 in Southport, Conn. McCobb served as director of the company from 1935 until his retirement in 1944. Earlier he was comptroller of the company. He also served as secretary-treasurer of Imperial Oil Limited, Canada.

•

Mrs. Janie Ryan Parker, wife of William G. Parker, paleontologist with Gulf Oil Corporation, died October 5 in Houston. At the time of her death Mrs. Parker was secretary to Ben C. Belt, vice president Gulf Oil Corporation, Houston Production division. Mrs. Parker had been with the company for 36 years and served as secretary to vice presidents, Underwood Nazro, Walter B. Pyron, L. P. Garrett and Belt.

•

Jorge L. Cumming, 58, head of exploration for Pemex and director of the International Geologic Conference to be held in Mexico City in 1956, died October 13 in Acapulco, Mexico. Cumming had been in charge of exploration activity for Pemex since 1953.

•

Henry M. Brown of Houston, attorney and oilman, died October 8 in Topeka, Kansas. Brown practiced law before turning to the oil field supply business and later to the producing and refining divisions. In Muskogee, Okla., Brown became legal counselor for Atlas Supply Company, then was treasurer of the Continental Supply Company in St. Louis prior to founding the Midland Gasoline Company at Conroe, Texas. He also was president of the Texas-Gulf Producing Company, Houston, for a number of years. Brown retired in 1948 after selling his interest in the Midland Gasoline Company to the Chicago Corporation and Warren Petroleum Corporation, Tulsa.

•

W. R. (Rusty) Wilson, 65, independent oil operator for the last 30 years in a number of the Kansas and Oklahoma fields, died in Kansas City, October 4.

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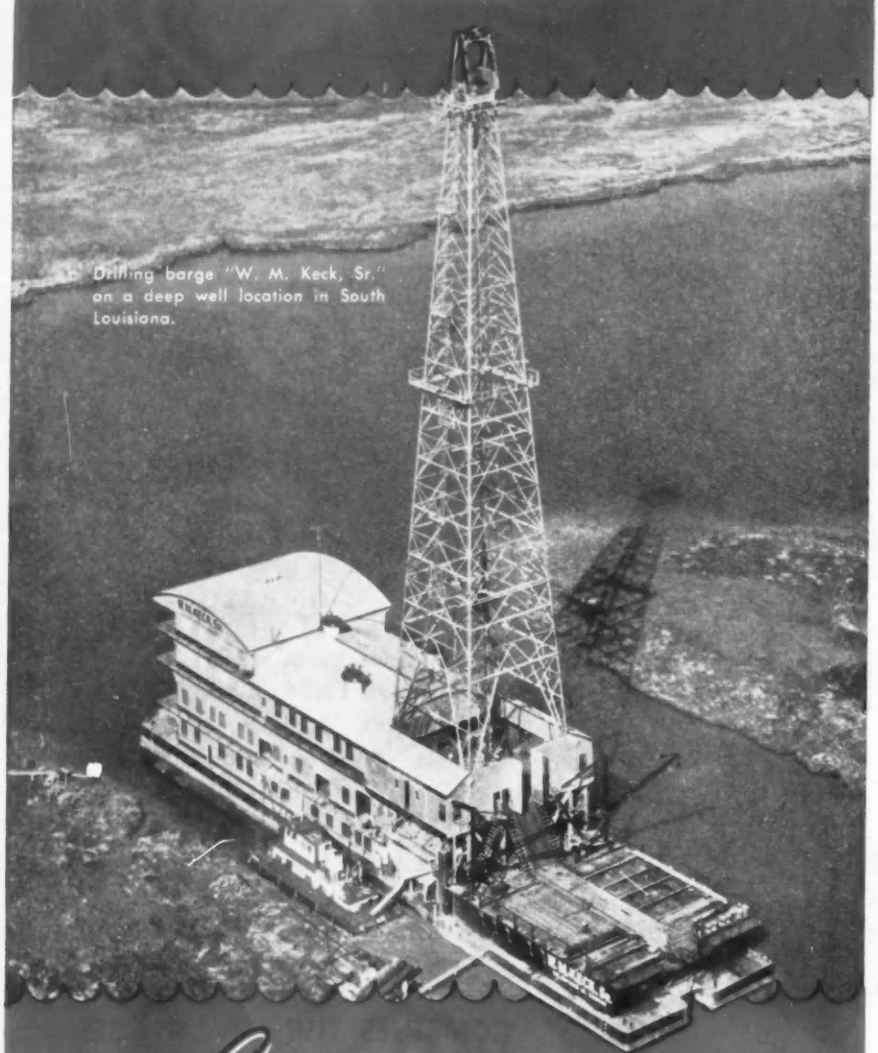

Drilling barge "W. M. Keck, Sr." on a deep well location in South Louisiana.

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Companies

CYPRUS OIL COMPANY of Los Angeles, has opened Houston offices in the Oil and Gas Building. Cyprus Oil is a subsidiary of Cyprus Mines Corporation, producers of copper on the island of Cyprus in the Eastern Mediterranean. **Horace N. Goodell,** Denver consulting geologist, and former chief geologist of the Rocky Mountain division of Union Oil Company of California, has been appointed manager of exploration of Cyprus Oil Company and will be located in Houston. Activities of **Lon D. Cartwright, Jr.,** vice president of Cyprus Oil and Cyprus Mines, will be centered at the Los Angeles home office, but he will spend some time in the Houston office directing company operations.

•

ROCK ISLAND REFINING CORPORATION of Indiana announces the removal of exploration and production offices from the Sinclair Building in Fort Worth to Denver. **C. B. Schwartz** is manager. The Denver office will handle company operations in Oklahoma, Kansas and the Rocky Mountains.

•

STANOLIND OIL AND GAS COMPANY'S district exploration office at Tyler has been augmented by a geophysical staff. The transfer of **Jack L. Mataya,** staff geophysicist, and **Jack W. Estes,** intermediate geophysicist, from Lubbock to the Tyler office will bring to 30 the total number of Stanolind Exploration department employes in Tyler. The addition of a geophysical staff will provide closer coordination of field activities of geophysical crews operated by Stanolind and those under contract to the company. In Stanolind's North Texas-New Mexico division there are, in addition to the Tyler office, geophysical offices in Abilene, Lubbock, and Midland, Texas, and Roswell, N. M. **J. D. Novotny,** field seismograph supervisor, will be in charge of the geophysical office at Tyler as well as the other four geophysical offices.

•

McRAE OIL & GAS CORPORATION, a newly organized Delaware corporation with general offices in Denver has acquired all assets of J. A. McRae, Limited and all of the outstanding capital stock of Roden & McRae Drilling Corporation in exchange for McRae Oil & Gas Corporation stock. This move gives the new company production in the states of Colorado, Wyoming, Montana, Texas and Oklahoma.

Directors of the new corporation which became operative at the close of business on September 30, include Henry C. Breck, David G. Baird, Joseph Patrick, Charles G. Cushing and Joseph Smith. Officers are J. A. McRae, president and director; E. C. Dorroh, vice president and treasurer; R. C. Potter, vice president and secretary; and G. G. Clayton, comptroller.

The wholly owned subsidiary drilling corporation which operated six drilling rigs and two large workover units in the Rocky Mountain area is also headed by McRae. Other officers are John Roden, vice president; Sam Rodgers, vice president; Les Walker, secretary; and Vera Lentz, treasurer. Directors of the subsidiary are McRae, Dorroh, Rodgers, Roden, Potter and Clayton.

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in the News

HALBERT AND JENNINGS, oil producers, announce the removal of their offices from the Empire Building in Denver to the Mile High Center, Suite 1019. The announcement is made by **Ralph C. Halbert, Dolphe E. Simic,** and **William D. Jennings.**

•

TAYLOR OIL AND GAS COMPANY, in a joint venture with **DELHI OIL CORPORATION,** will direct its activities for South Louisiana and adjacent areas from temporary offices in the Naomi Building, Lafayette, La. Permanent offices will be located in Building "R" of the Heymann Oil Center. **R. B. Gustafson, Jr.,** formerly of Taylor's Corpus Christi office, will be district geologist and manager of the Lafayette office, under the supervision of **Cecil D. Robinson,** division geologist for the Gulf Coast Division of Taylor Oil and Gas Company.

•

DRILLING AND EXPLORATION COMPANY, INC., has announced the following company changes in its Los Angeles office: **John H. (Jack) Lewis** has resigned as vice president—Foreign department. Lewis, an authority on foreign operations, has been with the company about 12 years, during which he has operated in most of the countries of the world. Drilling and Exploration Company, Inc.'s Foreign department is being combined with its Domestic Contract Drilling department and will be operated by **Robert L. (Bob) Rose.** Rose has been with Drilling and Exploration Company, Inc. for 11 years. He has been vice president of Drilling and Exploration Company, Inc.'s drilling subsidiary under which all of its domestic contract drilling has been done.

Wallace W. March, who has been with Drilling and Exploration Company, Inc. for 20 years and has been vice president and assistant to the president of the parent company, is being moved to Los Angeles where he becomes vice president and secretary and treasurer of the subsidiary. March has specialized in foreign contracts.

•

DOUGLAS OIL CO. of California has announced that a new department of exploration and production has been set up to facilitate the exploration and development of crude oil properties. The department will be headed by **Thomas A. Atkinson,** who has been elected a vice president of the company. From headquarters in Los Angeles he will direct activities on the company's properties in California and Peru. Atkinson has been affiliated with General Petroleum Corporation and Socony-Vacuum Oil Company since 1935. His most recent position was production manager for U. S. operations at Casper, Wyo. He is a graduate engineer from the University of California.

•

SIGNAL DRILLING COMPANY and associated companies have announced plans to open an area office in Denver to handle expanding activities in the Rocky Mountains and Canada. **F. M. Stevenson,** president, will move to Denver where offices have been established in the Patterson Building. Associated companies are the Signal Oilfield Service, Signal Exploration, Inc., and Pennant Drilling, Ltd.

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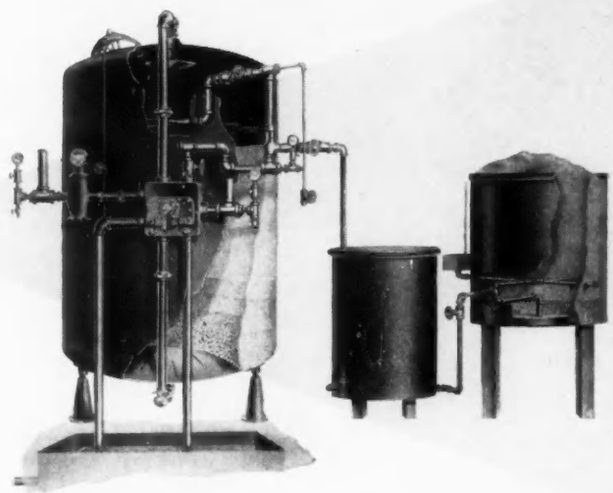
provide easy, economical operation



The Cochrane Hydromatic Single Control Valve provides positive, accurate control of all phases of the softening and regenerating cycle.

It is so simple to operate that no technical knowledge of the softening process or the equipment is required. High quality effluent is thus assured at a minimum cost and maximum delivery.

Cochrane engineers and manufactures every type of precipitation and ion exchange water conditioning equipment, thus assuring you unbiased recommendations for equipment best suited to your requirements. Cochrane's *complete* service provides single responsibility for engineering, fabrication and continued satisfactory operation.

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Reactors • Deaerators • Continuous Blow-Off • C-B Systems • Specialties

What's Happening

AMONG INDUSTRY ASSOCIATIONS

P. C. SPENCER, left, chairman of the API board of directors, presents the Gold Medal for Distinguished Achievement, to Wallace E. Pratt, formerly vice president of Standard Oil Company (N.J.), at the recent annual meeting of the API.

Gulf Coast Section SEPM Elects Officers

Stuart A. Levinson, Humble Oil & Refining Company, Houston, third from left, is congratulating Charles W. Stuckey, Union Oil Company of California, Houston, upon his election as president of the Gulf Coast Section of SEPM at the annual meeting of the Gulf Coast Association of Geological Societies held at the Rice Hotel, Houston, November 3-5. Levinson is the outgoing president. Other new officers looking on are, left, Fred L. Smith, Jr., consultant, Houston, treasurer; Stuckey; Levinson; E. H. Rainwater, Shell Oil Company, Jackson, Miss., vice president; and W. H. Akers, The California Company, New Orleans, secretary.

Spencer and Porter Reelected to API Posts

P. C. Spencer, president of Sinclair Oil Corporation, New York, was reelected chairman of the board of directors, and Frank M. Porter of Fain-Porter Drilling Company, Oklahoma City, was re-elected president of the American Petroleum Institute at the thirty-fourth annual meeting in Chicago November 9-11. A record attendance of 6541 was recorded.

B. Brewster Jennings, president of Socony-Vacuum Oil Company, New York, was reelected treasurer and Lacey Walker, New York, was reelected secretary. Three new vice presidents elected at this meeting were A. W. Thompson of A. W. Thompson, Inc., Houston, vice president for production; E. B. McConnell, Standard Oil Company (Ohio), Cleveland, vice president for refining; J. G. Jordan, Shell Oil Company, New York, vice president for marketing. Charles S. Jones of Richfield Oil Corporation, Los Angeles, was re-elected API vice president for transportation.

New directors elected include Rainey Elliott, Jones and Laughlin Supply Company, Tulsa; H. B. Gernert, Trigood Oil Company, Casper, Wyo.; J. G. Jordan, Shell Oil Company, New York; R. S. McFarland, Seaboard Oil Company of Delaware, Dallas; and A. W. McKinney, The National Supply Company, Pittsburgh.

New directors elected by the board for a two year term include Paul Kayser, El Paso Natural Gas Company, El Paso; and Roy J. Thompson, Apex Motor Fuel Company, Chicago. J. Porter Langfitt, The Pure Oil Company, Chicago, was named to fill the unexpired term of L. S. Wescoat. Thompson and McConnell, new vice presidents, are ex-officio members of the board.

Wallace E. Pratt, geologist-author-philosopher, received the API Gold Medal for Distinguished Achievement during the session. Pratt was formerly vice president and director of Standard Oil Company (N. J.) before his retirement. A past president of the AAPG, Pratt received the AAPG Sidney Powers Medal in 1945 and the AIME Anthony F. Lucas Medal in 1948. Pratt is the author of "Oil in the Earth," as well as more than 100 technical papers.

Scott Elected President Of Petroleum Association

A. W. Scott, president of Wolf's Head Oil Refining Company, Oil City, Penn., was re-elected president of the National Petroleum Association at the 52nd annual meeting in Atlantic City, N. J.

Other reelected officers include Fred G. Bannerot, Jr., of Elk Refining Company, Charleston, W. Va., first vice president; Paul R. Beck, Pennsylvania Refining Company, Butler, Penn., second vice president; E. M. Lyons, Philadelphia, recording secretary; G. B. Hunter, Quaker State Oil Refining Corporation, Oil City, Penn., treasurer; and Fayette B. Dow, Washington, D. C., general counsel.

Governor to Be Guest of NOMADS

The honorable Dan Thornton, Governor of Colorado, confers with R. K. Franklin, right, president of the Houston Chapter of Nomads, about his trip to Houston on December 13, when the governor will be guest speaker at the Nomads' meeting at Houston Country Club. Thornton was elected to the Colorado State Senate in 1948 and was elected governor in 1950. He has announced his retirement from office when his present term expires in January, 1955. Thornton has served as chairman of the National Governors' Conference and was appointed by President Eisenhower as a member of the President's Commission on Intergovernmental Relations.

2300 Attend Meeting Of AIME Petroleum Branch

Presentation of 45 technical papers, announcement of 1955 officers, entertainment program, and luncheon and banquet talks by industry's top leaders were highlights of the American Institute of Mining and Metallurgical Engineers, Petroleum Branch fall meeting held in San Antonio, Texas, October 17-20. Total registration for the four-day meet was about 2300, including 525 women, just 100 short of the record attendance at a similar meeting in Dallas in 1953.

Robert B. Gilmore

The Southwest Texas Section, headed by Chester L. Wheless, LaGloria Oil and Gas Company, was host for the meeting. Presentation of technical papers were divided into groups as follows: logging, field case histories, gas engineering, and injection, production operations, reservoir model studies, economics and management, production equipment, formation fracturing, drilling and well completion, geological engineering, drilling and reservoir engineering.

Officers elected for 1955 include Robert B. Gilmore, senior vice president and director, DeGolyer and MacNaughton, chairman; Phil J. Lehnhard, field chairman of the East Texas Engineering Association, Kilgore, Texas, vice chairman; and G. Latham Yates, consulting petroleum engineer and a senior member of Amstutz and Yates, Inc., Wichita, Kansas, vice chairman. Newly elected members to the executive committee are George R. Gray, manager of the Gulf Coast Sales and Service Laboratory of the Baroid Sales Division, National Lead Company, and Earl Kipp, chief engineer, The California Company, New Orleans. These officers will take office after the national AIME meeting to be held later this year in New York City. Retiring officers are John R. McMillan, Fullerton Oil Company, Los Angeles, chairman; D. W. Akins, Ohio Oil Company, Findlay, Ohio, vice chairman; and Tom C. Frick, The Atlantic Refining Company, Dallas, vice chairman.

Phil J. Lehnhard

G. Latham Yates

The welcoming luncheon featured Tom Sealy, Midland, chairman of the Board of Regents, The University of Texas, who spoke on "Education and the Petroleum Industry."

At the Petroleum Branch membership luncheon Chairman John R. McMillan

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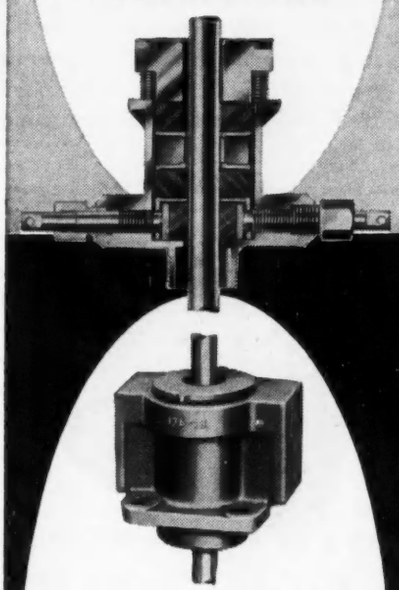
COMBINATION
That Provides
CONTINUOUS
LUBRICATION
OF
POLISHED ROD



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Ratigan Stuffing Boxes receive lubrication direct from pumping well when it is not heading while the Ratigan Lubricating Cap lubricates the polished rod when the flow of oil in the tubing is retarded.

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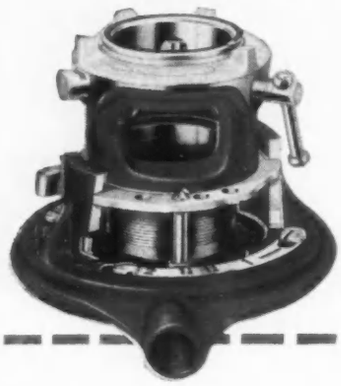
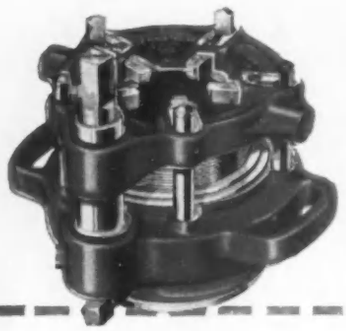
Threads 1" to 2" pipe with 1 set of dies —and it won't jam. Sets to pipe size in 10 seconds! Workholder sets to size instantly. 65R's great popularity has been earned on thousands of tough jobs.





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For 2½" to 4" pipe—4 sets of 5 dies. Loop handles make it easy to carry, put on pipe. Workholder sets easily to size *before* putting on pipe. Easy upkeep, oilless bronze bearings.

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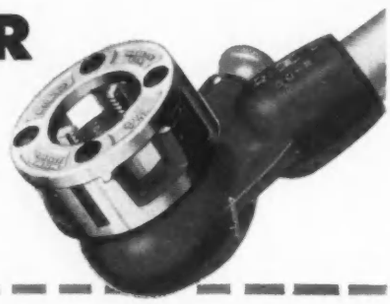
Drop-head dies, ⅛" to 1", snap into drive ring, can't fall out. Dies reverse for close-to-wall threads—no special dies needed. Other sets in any combination of sizes from ⅛" to 2".



For perfect threads with most speed and ease, ask your Supply House for RIDGID's.

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RIDGID Work-Saver Pipe Tools

reported on the Branch and Institute activities. He also reiterated the oil industry's stand in regards to its discovery rate. "As long as there are petroleum engineers and societies to develop and transmit technical papers to our membership," he said, "we will increase present recovery of oil from existing oil fields and to do much more efficient job of recovery on newly discovered oil."

At the economics and management session, in a paper, "The Economics of the International Petroleum Industry," prepared by A. H. Chapman and James Terry Duce, both of Arabian-American Oil Company, New York City, the group was told that Texas will not continue long as the world's top producer of oil. The two men predicted that in the near future, all roads would lead to the Middle East where vast reserves are being discovered every year.

W. R. Mizelle Appointed OIIC Editorial Director

The Oil Industry Information Committee of the American Petroleum Institute has announced the appointment of William R. Mizelle as editorial director. Mizelle will supervise the preparation of editorial material for publication by the Oil Industry Information Committee, a nation-wide organization of petroleum industry representatives dedicated to defining and furthering the services performed by that industry.

William R. Mizelle

Until joining the OIIC, Mizelle was project manager of the McGraw-Hill Book Company's Technical Writing Service, having served the McGraw-Hill organization in various capacities since 1949. Previously, he was associated successively with the Birmingham News-Age Herald, the United Press Associations, and the New York Times. Mizelle has been a frequent contributor to national magazines, and is the author of The United States Looks at Inter-American Trade (Caribbean at Mid-Century).

American Welding Society To Sponsor Awards Program

The American Welding Society will award $700 in prizes for the two best articles on welding to appear in undergraduate publications during the current school year. Author of the best article and the student magazine or paper in which it appears will each receive $200. Author of the second best article and the publication in which it appears will each receive $150.

These awards are made annually by the American Welding Society under the A. F. Davis Undergraduate Welding Award program. Sponsored by A. F. Davis, vice president and secretary of the Lincoln Electric Company, Cleveland, Ohio, the program's purpose is to stimulate interest of college students in the art and use of welding.

Articles on any type of welding or its application to design and construction will qualify. To be eligible, the article must be published between April 1, 1954, and June 1, 1955.

What's Happening

AMONG SERVICE AND SUPPLY MEN

Norman McEachen

Charles Gardner

C. K. Madison

Roy R. Bush

W. R. McLaughlin

W. P. Weatherby

A. G. Lindquist

E. H. Bodinson

B. L. Hindman

S. G. Paddock

Frank K. Becker

H. L. Harris

Kermit Williams, former executive vice president and secretary of E. H. Edwards Company, has been elected executive vice president and treasurer. He replaces **Norman McEachen,** who retired. McEachen joined the Edwards Company in 1938. **Cynthia Williams,** formerly assistant secretary, has been elected secretary of the corporation, and **Larry Rosa** was appointed assistant treasurer. **George Wagner,** chairman of the board; **Sterling Edwards,** president; and **Russell F. Hendrick,** vice president—sales, were re-elected to their posts.

Charles Gardner has been appointed sales manager, Drier division of Witco Chemical Company. Until recently he was eastern sales manager, Technical Sales and Service, of Advance Solvents & Chemical Corporation and technical director, Advance International, Ltd.

Carl K. Madison, Midwestern regional manager for Rockwell Manufacturing Company, has been promoted to vice president—new product sales for the entire division. This is in line with the company's Meter and Valve division reorganization in the Midwestern sales region, which has now been divided into two new regions. **Roy R. Bush,** Tulsa, district manager, has become Midwestern regional manager with headquarters at Tulsa; and **W. R. McLaughlin,** manager of the Dallas office, becomes Southwestern regional manager with headquarters at Dallas.

W. P. Weatherby has been appointed sales engineer for the Corpus Christi district of Welex Jet Services. Weatherby, who has been with Welex for two years, will maintain an office in Pleasanton, Texas.

A. G. Lindquist, secretary and comptroller of Gardner-Denver Company, has been elected vice president of the company. Lindquist has been with the company for 16 years and will continue as secretary and comptroller in addition to his new duties.

Earl H. Bodinson has been appointed Eastern division sales manager of Hammond Iron Works with headquarters at the New York City offices. Bodinson has spent 16 years in the eastern oil and chemical industries, the last eight years with Hammond Iron Works.

B. L. Hindman has been appointed a special representative for the sale of Gardner-Denver mud pumps for The Continental Supply Company in Dallas. Hindman joined Continental in 1930, spending the past two years in Shreveport, La., as assistant division manager of the Arkansas, North Louisiana, Mississippi and East Texas division.

S. G. Paddock, formerly sales manager for the Dallas division of Burgess-Manning Company, has been named the Dallas division manager and director of a new national sales organization. He will direct and correlate sales operations of the company's divisions at Libertyville and Dallas with three primary sales districts covering the entire country. The districts are at Chicago, Dallas and New York and include related sales operations in each district. **Frank K. Becker** of Dallas has been named manager of the Dallas district and **H. L. Harris** has been named to assist in Dallas district sales. Other appointments include **H. A. Dietrich,** manager of the Chicago district; **F. C. Duerr,** assigned to Chicago district sales; **W. A. Carroll, Jr.,** district manager of the New York district; and **R. T. Oliver, Jr.,** assigned to New York sales.

F. A. Henry, formerly assistant to the general manager of A. O. Smith Corp., in Milwaukee, has been appointed general manager of the corporation's Pacific Coast Works at Los Angeles. He succeeds A. W. Shuman, who has resigned.

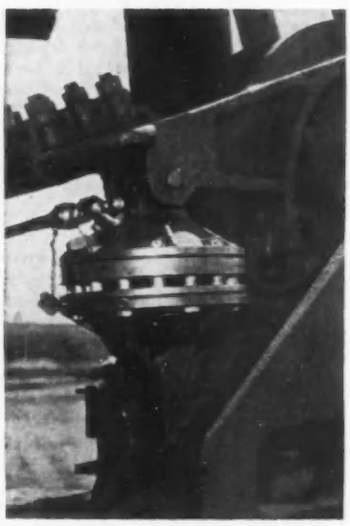
Bradlee V. B. Postell recently was named assistant to Dr. Howard I. Cramer, vice president, development, Sharples Chemicals, Inc., subsidiary of the Pennsylvania Salt Manufacturing Company. In this capacity he will assist in staff activities incident to the company's development program.

Phil L. Lynn, field representative for U. S. Steels Oil Well Supply Division, has been transferred from Cushing, Okla., to Lindsay, Okla. Lynn joined "Oilwell" in 1950 at Healdton, Okla. The following year he transferred to Cushing and was promoted to field representative there early in 1954.

W. F. George, district sales manager for Hooker Electrochemical Company, has joined the Witco Chemical Company as special assistant to the president. George organized and conducted W. F. George Chemicals, Inc., for several years and later was co-publisher of "Chemical Industries," now known as "Chemical Week."

THIS IS THE LAST WORD IN WEIGHT-INDICATOR ACCURACY

Martin-Decker's new Sensater gives you friction-free weight indication



The E-80 Sensater is a new kind of *diaphragm* pressure transformer. It doesn't deflect, but moves with its backing plate. The slightest movement of your Ideal Wire Line Anchor creates a piston-like stroke, without a friction-causing piston-rod or packing.

With the new ultra-perceptive Sensater, your Martin-Decker Type "D" or "E" Weight Indicator becomes a more valuable tool than ever for such precision jobs as fishing, milling, cutting, and coring — a small investment to increase the life of diamond bits and other costly equipment making up a half-million-dollar drilling rig.

The big color-keyed indicator dial instantly tells you the accurate weight of the drill string and the net weight on bit in thousands of pounds. Included is a vernier, sensitive to minor weight changes.

Martin-Decker's familiar red box is packed with valuable drilling information. The instrument panel includes a weight indicator, mud-pressure gauge, rotary torque gauge, draw-works speed selector, rotary-table tachometer, and a vapor-proof light. On the back is a 24-hour recorder with pens for weight, mud, and torque. Martin-Decker engineers will work out other instrument combinations for your special drilling requirements.

For further information ask for Bulletin P-10. Write: Martin-Decker, 3431 Cherry Ave., Long Beach 7, California, Dept. B-1.

DISTRIBUTORS: T. C. Cullen, Bakersfield, California; Reed Roller Bit Co., Houston, Texas; Reed Roller Bit Co. of Canada, Ltd., Calgary and Edmonton, Alberta. Martin-Decker Weight Indicators and Ideal Wire Line Anchors are also sold through The National Supply Co., The National Supply Co. Export Division and other recognized supply houses.

MARTIN-DECKER CORP.

HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

O. A. Johnson

J. H. Gifford

O. A. Johnson has been named manager of the Edinburg, Texas, office of **Southern Engine & Pump Company** and **Cleburne E. McCaslin** has been transferred to the sales staff in Edinburg. Johnson joined the firm in 1948 and McCaslin has been associated with the company in Houston for six years.

John H. Gifford has been named technical director of the Carbon Black division, **Witco-Continental's** Akron, Ohio, office and **Robert B. Sucher** has been appointed assistant sales manager, rubber chemical products promotion. Gifford formerly was associated with the B. F. Goodrich Company. Prior to joining Witco, Sucher was affiliated with Marbon Corporation (Borg-Warner) and with the Inland Manufacturing Company.

Paul A. Manor, a design engineer with **Surface Combustion Corporation** at Columbus for the past ten years, has been named chief engineer of **Rockwell Manufacturing Company's** lubricated plug valve plant at Barberton, Ohio. A native and 25-year resident of Toledo, Ohio, Manor attended Ohio State University and the University of Toledo. He joined Surface Combustion in 1931 and worked at the Toledo plant for seven years before being transferred to Columbus.

James C. Gray has been appointed vice president—operations—coal of U. S. Steel Corporation. Gray comes to Pittsburgh from U. S. Steel's Tennessee Coal & Iron division, where he has been manager of manufacturing operations. In his new position he will head the company's coal mining activities in Pennsylvania, West Virginia and Kentucky. He succeeds **Karl L. Konnerth** who resigned.

Russell Herig, formerly associated with Nye Tool Company, Chicago, has been appointed field sales manager for Beaver Pipe Tools, Inc.

Russell Herig

Herig comes to Beaver with more than 21 years of technical experience in the mill supply business. Prior to his association with Nye Tool, Herig was sales representative for Long Island Hardware Company and C. H. Tieboutt and Sons Company of New York.

JOY 200-Series Motorized Drill Rigs

Built and Field-Proved in 3 models to do your job best!

This family of fast, highly mobile oil field drills—the JOY 225, 250 and 275 Motorized Drill Rigs—are built for deep structure-testing and water-well work, or shallow slim hole production, down to 3000 feet.

They are truck or trailer-mounted units with interchangeable parts, reversible rotary mechanism, single or compound engine drive, hydraulic or ordinary feed. An exclusive feature of the 225 and 250 Drill Rigs is the JOY Automatic Hydraulic Chuck, a proved labor saver—reduces costs, increases speed, actually can mean as much as 200′ more hole per day. *Let us give you complete details.*

● *Write* **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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JOY

WORLD'S LARGEST MANUFACTURER OF CORE DRILLS AND MOTORIZED DRILL RIGS SINCE 1851

George H. Shumaker has been named district manager for The National Supply Company in the Michigan district with headquarters in Mt. Pleasant. **R. T. Harris** has received an appointment as district manager in the Illinois district. **Roger L. Dailey**, recently promoted to division manager of the Eastern division, previously served as district manager of both districts.

Herbert L. Waltman has been named manager of the Pacific Northwest district for Leschen Wire Rope division, H. K. Porter Company, Inc. The district covers Washington, Oregon, Western Idaho, Montana and North Dakota with headquarters in Seattle.

Patrick J. Massmann and **James R. Johnson**, both formerly of the New Orleans office of Lorac Service Corporation, have been promoted to administrative jobs in the Houston Lorac operations headquarters. Massmann, who was network chief in New Orleans, has been named a supervisor in the Houston office, and Johnson, who was chief computer in New Orleans, has been named an administrative assistant in the Houston office.

Robert C. Craig has been named city representative for U. S. Steel's Oil Well Supply division in Denver. Craig joined Oilwell in 1945 and prior to his new appointment, he held various sales and managerial positions at Artesia, Colo.; Worland, Wyo.; Billings, Mont.; and Casper, Wyo.

Worthington Presents Plaque

F. J. Whelan, vice president of Worthington Corporation, presents a bronze plaque to R. J. Cooper, vice president of Bradford Supply Company, in commemoration of the long association of the two companies dating back to 1926 and the part their combined efforts have played in providing water-flooding equipment for secondary oil recovery.

Paul E. Shea is one of the three store managers appointed recently by U. S. Steel's Oil Well Supply division. Shea, manager of the Fort Morgan, Colo., store, will be succeeded as manager of the Cut Bank, Mont., store by **Robert W. Anderson**. The third appointment is that of **Donnie E. Bowers**, who becomes store manager at Glendive, Mont. **Frank J. Long** has been named field representative at Casper, Wyo., for Oilwell. Since joining the company in 1949, Long has held various sales and managerial positions at Glendive, Mont.; Williston, N. D.; and Fort Morgan, Colo.

T. W. Lindsey, formerly sub-district superintendent for Lane Wells at Victoria, Texas, has been transferred to Hobbs, N. M., as sub-district superintendent there. **G. K. Chandler**, formerly station superintendent at Falfurrias, Texas, has been appointed sub-district superintendent at Victoria. **J. W. Maurice, Jr.**, sub-district superintendent at Hobbs, is transferred to Falfurrias station superintendent and **R. H. Ault**, formerly operator in charge of Pleasanton, is reclassified station superintendent there.

Herman J. Spoerer, director of industrial relations for The Youngstown Sheet and Tube Company, was elected vice president for industry and chairman of the industrial conference at the 42nd annual congress of the National Safety Council. In his new position Spoerer will serve as a member of the National Safety Council's board of directors and as a member of the board's executive committee.

Holland A. Hatcher has been appointed manager of the Arkansas City, Kansas, store of U. S. Steels Oil Well Supply Division. **James A. Brunnemer** succeeds him as field representative.

Other appointments include Clair Haas, manager of the Williston, N. D., store; Donald Earl Mosher, field representative at Bakersfield, Calif.; George H. Fletcher, field representative at Fort Morgan, Colo.; Louis R. Roter, field representative at Monahans, Texas; and Wayne B. Atkins, field representative at Hobbs, N. M.

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NEW FEATURES BUILT INTO PORTABLE MAST

Advanced developments designed into the FOX PORTABLE MAST make it your logical buy for efficient and economical operation.

Ask your supply company for new specifications and a quotation on a 133-foot, 625,000-pound capacity FOX PORTABLE MAST. You'll like the new improvements and exclusive features built into this highly successful mast . . . now being used in most major oil fields in the U. S. and Canada.

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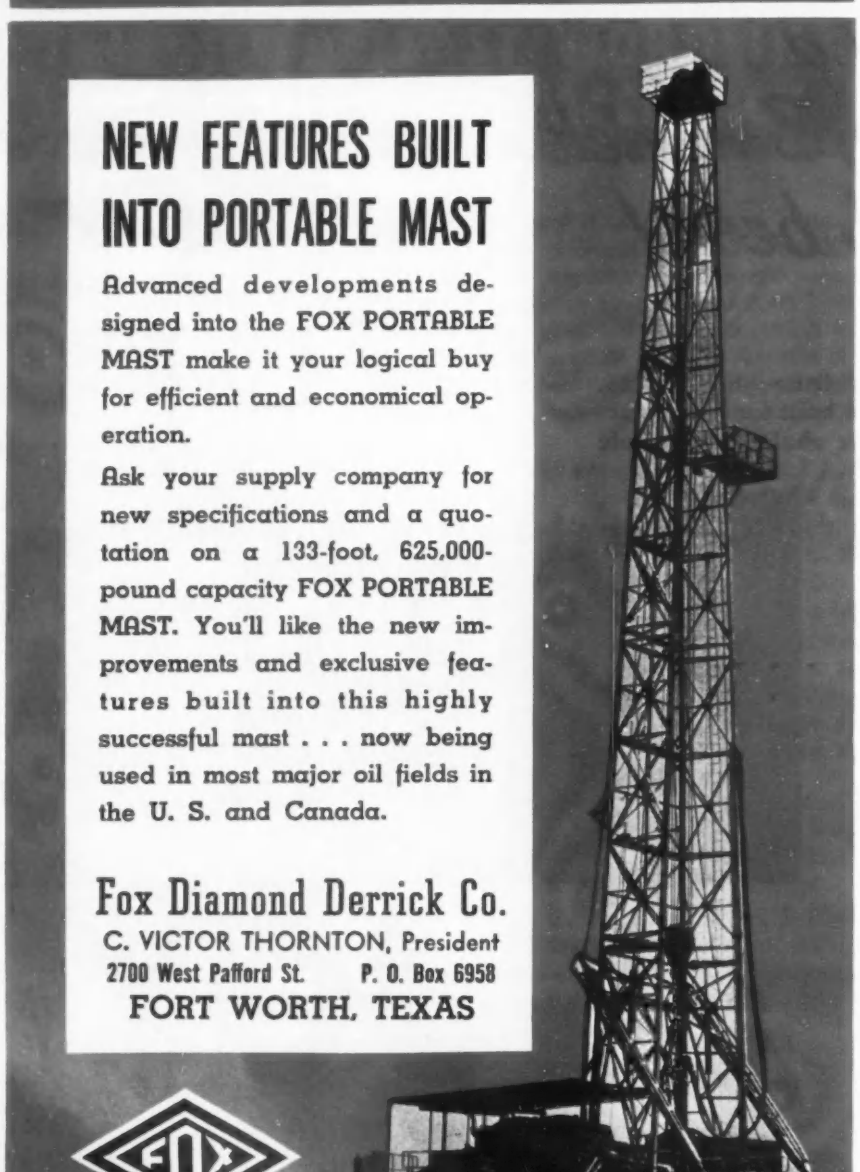


Norman Spice

Charles Zaoral

D. E. Ramsey

R. S. Battles

R. F. Benda

Bruce Cordary

Edward Norman Spice has been named assistant to district engineer at Wetaskiwin, Alberta, Canada, for U. S. Steel's Oil Well Supply division. Spice was employed by Oilwell in June, 1954, at Wetaskiwin as a junior engineer, the position he held until his new appointment.

Charles T. Zaoral, vice president of operations and a director of the company for two years, has been elected president of The New York Air Brake Company. **Bernard Peyton,** formerly president, was made chairman of the board. Before joining New York Air Brake in 1952, Zaoral was general manager of the International division of Bendix Aviation Corporation for eight years and a director of its subsidiaries in Canada and Australia. Previously he was associated for 15 years in various executive capacities with General Motors Corporation.

D. E. (Pat) Ramsey has been promoted to the newly-created position and title of manager of operations for Dowell Incorporated in the company's general offices in Tulsa. Ramsey has been district manager of Dowell's West Texas operations with headquarters at Midland, Texas. **Edward F. Kelly,** formerly Dowell district area manager for West Texas, has succeeded Ramsey as district manager.

Robert F. Benda has been appointed district manager in the Gulf Coast area for **Willis Oil Tool Company** of Long Beach, Calif. Benda will be in charge of sales and service and will maintain offices and factory warehouse stocks of the complete Willis line of chokes, rotary flow beans, arc rod, tubing and rotors at 2012 Taft Street, Houston. Benda is a graduate engineer and for the past eleven years has been engaged in oil industry equipment engineering sales work in the southwest.

R. S. (Bob) Battles has been added to the sales staff of Thornhill-Craver Company of Houston to serve Oklahoma and Kansas. His headquarters will be at Pauls Valley, Okla.

John W. Jordan, Jr., has been promoted to sales engineer for the Odessa district office of Welex Jet Services. Jordan, who joined Welex a year ago, will work in field contact work with producers throughout the Permian Basin area.

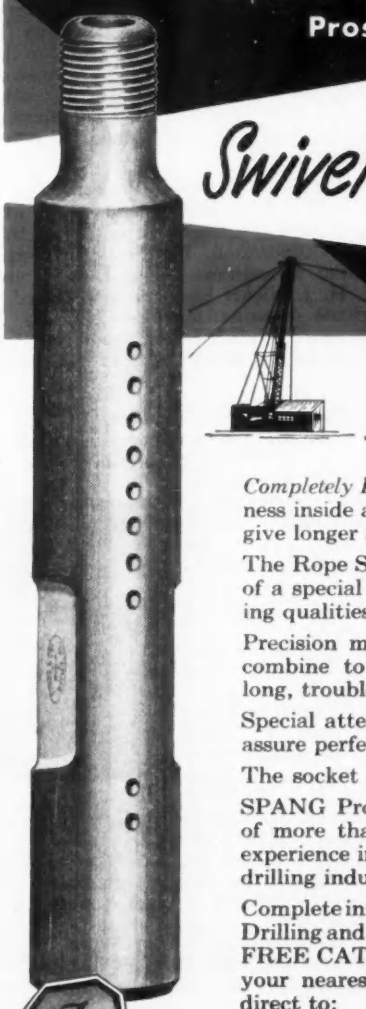
Bruce J. Cordary has been appointed hydraulic field engineer for The Denison Engineering Company of Columbus, Ohio, in the Houston area. Cordary, previously associated with Core Laboratory Incorporated and HOMCO, both of Houston, as a field engineer, has recently completed a hydraulic engineering training program in the company's home offices and plant in Columbus.

FOR MAXIMUM STRENGTH and SERVICE

SPANG

Prosser-Type

Swivel Rope Sockets



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Completely Heat-Treated for uniform toughness and hardness inside and out, SPANG Prosser-Type Rope Sockets give longer service, greater footage at lower cost.

The Rope Swivel and the internal Swivel Seat are made of a special hard steel, heat-treated for maximum wearing qualities.

Precision machining and inherent, high steel strength, combine to provide an exceptionally strong joint for long, trouble-free service.

Special attention is given to finishing the inside bore to assure perfect cable set.

The socket neck is grooved for the use of fishing tools.

SPANG Prosser-Type ROPE SOCKETS are a product of more than 60 years engineering and manufacturing experience in the production of high quality tools for the drilling industry.

Complete information on Rope Sockets and other SPANG Drilling and Fishing Tools is available in this FREE CATALOG. For your Copy, consult your nearest SPANG DEALER or write direct to:

The HIGHER STANDARD

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(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

INCREASE PRODUCTION

CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less down-time, use world famous Miller Sand Pumps.

PUMP & BAILER SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 In.
Lengths—20, 25, 30 ft.

Composite Catalog, Page 3433

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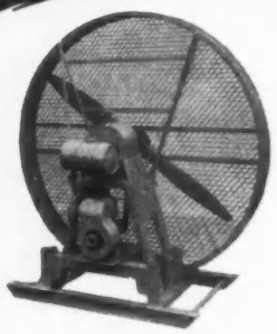
Bugs and Business DON'T MIX!



Ever try to stab a joint or run a spinning line while a stink bug crawled up the back of your neck?

A BEMCO Bug Blower would have prevented your predicament. The baby hurricane created by its 66" airplane type blade would have taken that varmint away from there, and what's more *kept the entire floor bug-free.*

Think back to your stink bug . . . and then remember to order a BEMCO Bug Blower *today.* One on each of your rigs will keep the bugs out of your business.

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EXPORT Baird Supply Co. Inc
420 Lexington Ave., New York, N. Y.

R. F. (Bob) Gregg

Guy W. Bigham

Guy W. Bigham has been named manager of the Used Equipment division of Continental Supply Company with headquarters in Dallas. Bigham was division sales representative for the Arkansas-North Louisiana, Mississippi and East Texas division in Shreveport, La., since 1948. Continental Supply has also named **R. F. (Bob) Gregg** as division manager, Tubular Sales for the Arkansas, North Louisiana, Mississippi and East Texas division. For the past two years Gregg has been located in Houston as district manager of the South Central Texas district. In his new position he will have headquarters in the Shreveport division office. Bigham, who joined Continental 31 years ago, has been store manager at Shreveport and Rodessa, La. Gregg has been with the company for the past 15 years, with time out for Air Force duty. He served as field salesman at Odessa, Texas, and Hobbs, N. M.; store manager at Snyder, Texas; city salesman at Midland, Texas; and tubular salesman in Houston.

Don Mitchell, location manager at Roswell, N. M., for Schlumberger Well Surveying Corporation, has been transferred to Dallas as assistant to the division manager. **H. J. Nickel** has been transferred to Perry as location manager and **R. W. Bashe**, formerly at Perry, moves to Ardmore, Okla., to take over location manager duties.

C. W. Snider has been appointed assistant to **E. B. Hill**, vice president and director of sales, **Gar Wood Industries**, Wayne, Mich. Snider will assist Hill in the administration of sales and marketing functions for all Gar Wood products.

C. W. Snider

Snider has been assistant sales manager of Gar Wood truck equipment since April, 1953, when he joined the company. Before that he was assistant to the president of Sparks-Withington Company for five years. He also was in business for himself for a number of years, which included a period of manufacturing wire specialties and 10 years in the brokerage business.

His appointment at Gar Wood follows completion of a new product development and re-engineering program covering truck equipment and construction machinery. He will relieve Hill of central sales administrative details in a concentrated sales effort planned for these new lines in the construction and automotive fields, including export sales.

HIGH *Efficiency* with
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You engineers know that a bakelite material, that can remain unchanged for *15 hours, under critical operating conditions, while competitive products under similar test conditions were destroyed, is a proved: highly effective material.

FRANCE CARBON-BAKELITE PISTON RINGS for your gas compressors will outlast any comparable material—no deterioration with age or use; not affected by wet or sour gases.

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Ask the Texas Employers representative nearest you to show you more of these letters, as proof of what Texas' largest writer of Workmen's Compensation Insurance can do for you.

40TH ANNIVERSARY 1914-1954

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"This is a very nice savings, as it represents, together with premium discounts, a total return of 36.5% of the premiums we paid to your company.

"Naturally we realize this would not have been possible without the fine cooperation we received from your claims and safety engineering departments. We are happy with the long and friendly association we have had with you, and we are glad for you to use this letter as our recommendation of your company in your sales solicitations."

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TEXAS EMPLOYERS INSURANCE ASSOCIATION
HOME OFFICE - DALLAS, TEXAS

Byron Post has joined Harbison-Fischer Manufacturing Co., of Fort Worth as city offices sales representative for the Fort Worth-Dallas area. He was formerly manager of the Fort Worth area sales office of Oilwell Supply division of U. S. Steel Corporation. Harbison-Fischer manufactures and markets sub-surface oil well pumps and related production equipment. Post will make his headquarters in Fort Worth.

Byron Post

NEW WAREHOUSE and office building of Otis Pressure Control, Inc., has been opened in Corpus Christi, Texas.

BOWEN RELEASING SPEARS

Have a Perfect Releasing Mechanism

Bowen Releasing Spears not only insure the ability to pull the fish but also permit *release* at will. In the releasing position, there is no possible means of forcing the slips outward. The slips are in a neutral slot which insures that they cannot be expanded to contact the fish.

For your inside-the-pipe jobs and for holding liners and casing while landing, this efficient spear—with only six simple parts—gives a positive internal grip on the pipe. Easily withstands hours of steady jarring, yet release has never been known to fail because of its *perfect releasing* mechanism.

If It's a Tough Spear Job, Call Bowen!

Write for a free copy of Bowen's Operation and Instruction Manual which tells of the greater service and satisfaction to be obtained from BOWEN RELEASING SPEARS.

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NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL R. WITTICH, JR.

Otis Pressure Control Expands Southwest Texas Facilities

Otis Pressure Control, Inc., has opened a new 4000 square foot warehouse and office building in Corpus Christi as part of the company's general expansion plans in South, East, and West Texas and at its home office and manufacturing plant in Dallas.

The firm is in its twenty-sixth year and has branch offices in all major producing areas in the Mid-Continent and Gulf Coast regions. According to W. K. Waters, division manager in charge of the Corpus area, the company is working ten wire line and service truck units out of Corpus and in Falfurrias and Victoria, which are district offices under the Corpus branch.

The manufacturing facilities and offices in Dallas will be doubled by a building program now under way. H. C. Otis, Jr., executive vice president, has announced that branches in Odessa and Longview, Texas, also will be enlarged.

Sargent Engineering to Handle New Line of Production Equipment

Sargent Engineering Corporation, announces the addition of a line of production equipment supplies to be sold through its 22 field stores.

V. A. Kelley

Heading this addition is V. A. Kelley, formerly Mid-Continent sales representative and more recently representing Bethlehem Steel Company and Johnson-Fagg Engineering Co., who has been appointed manager of production equipment supplies for Sargent Engineering.

Kelley attended University of Oklahoma until 1932 and worked as roustabout and roughneck for Hunt Tool Company and Sun Oil Company at Kilgore, Texas. He first joined Sargent in 1936 at Shawnee, Okla. He has been stationed at Tulsa, Dallas, Houston and also covered the West Texas, New Mexico territories.

MORE THAN 65 YEARS SERVICE to Mid-Continent Supply Company is represented by these men. Left to right are R. L. McAnally, Ken W. Davis and P. Z. Hilliard.

Mid-Continent Supply Presents Service Awards

In recent informal ceremonies, two employees were presented 20-year service awards by the president of Mid-Continent Supply Company, Ken W. Davis, in his Fort Worth offices.

The employes are P. Z. Hilliard, director of purchases, and R. L. McAnally, West Texas-New Mexico division sales manager, both of whom came to work for Mid-Continent in August, 1934.

In receiving their golden replicas of the Mid-Continent world and derrick emblem, with a diamond for each five-years service, Hilliard and McAnally brought to ten the total Mid-Continent family members wearing 20-year service awards.

Hilliard began his Mid-Continent service in Lake Charles, La. He and McAnally opened the original Mid-Continent store in Kermit, Texas, in 1935. Hilliard's Mid-Continent career then took him east, to Kilgore, Houston, Lake Charles and New Orleans, where he served as district manager before transferring to the Fort Worth headquarters of the company. He was made director of purchases in 1953.

McAnally has worked during his entire Mid-Continent career in West Texas and New Mexico. He served as store manager in Kermit and Lovington and was district manager in Odessa before assuming his present position. In addition to his job as division sales manager, McAnally also heads up Mid-Continent operations in the San Juan Basin. He headquarters in Farmington, N. M.

Oil Well Supply Announces Store Opening in Kansas

Opening of a new branch store at Medicine Lodge, Kansas, has been announced by U. S. Steel's Oil Well Supply Division.

A combination branch store and warehouse, the new unit was established to expand "Oilwell's" service to the rapidly expanding drilling and production activities in that area.

Raymond H. Miller has been appointed store manager and Lewis Y. Poland named field representative at Medicine Lodge. Miller is a native Kansan. He joined "Oilwell" in 1948 at El Dorado, Kansas, after six years oil company experience. In 1952 he transferred to Stafford, Kansas, as store manager, the position he held until his new appointment.

Poland was employed by "Oilwell" in 1947 at Ellinwood, Kansas. He transferred to Russell, Kansas, the following year and since 1952 has served as field representative at Ellinwood.

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Perk Sales & Service	Houston, Texas	W. O. Nelson	Farmington, N. M.
F. M. Farrier	Wichita Falls, Texas	Longley Y. Cia., S.R.L., (Ken Langley)	Buenos Aires
Garlick Sales & Service	Oklahoma City, Oklahoma	L. W. Mauck	Great Bend, Kansas
Northern Well Equipt. Co.	Tioga, N. Dak.	Joe Perry	Salem, Illinois

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YET THIS FLOMAX-15 IS MADE OF TOUGH IRON FOR LONG LIFE
EASY TO HANDLE——WEIGHS LESS——COSTS LESS
FLOMAX Super Hard Seals provide longer trouble-free pump life without nuisance of filling grease cups or fear of dirty grease.
FLOMAX Open Adaptor construction protects your engine from stray pumpage. Also provides plenty of room to work and see when servicing pump.
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Higher Capacities and Higher Heads
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MARINE PRODUCTS COMPANY
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NEW DIVISION HEADQUARTERS and store of Republic Supply Company was opened last month in Houston.

Republic Supply Opens New Store in Houston

A new $150,000 Republic Supply store and division headquarters opened in Houston, Texas, in November to meet the increasing demand for oil equipment supply and service in that Gulf Coast area.

Cooper Kinney, vice president in charge of operations in the Gulf Coast area, for the Republic Supply Company, will center his operations from the new location.

The 32,000 square feet of floor space provided in the new building will contain facilities for the supply store, warehouse and executive and sales offices including a sales lobby and a dormitory space for in-training personnel.

The Republic Supply Company was founded in Port Arthur, Texas, in 1910. It is owned by Robert S. Kerr and D. A. McGee and associates of Oklahoma City.

Franks and Reynolds Perfect Aluminum Telescoping Derrick

The first all-aluminum telescoping derrick for use on portable oil field servicing units has been perfected through the collaboration of the Franks Manufacturing Corporation of Tulsa, Okla., and the Reynolds Metals Company of Louisville, Ky. The first such derrick has been built in the Franks Tulsa plant, and a demonstration held in November on the Franks plant testing grounds.

This all-aluminum derrick is another in a series of Franks improvements to make oil well servicing units and drilling rigs 100 percent portable and yet stay within highway weight limitations, according to Carl White, Jr., president of the Franks company.

This new derrick is built of square tubing aluminum legs and bracings, and effects a saving of more than 40 percent in weight. Although it costs more at present than a steel derrick, Franks thinks more experience and mass production will soon bring the price down to a level competitive to steel. The derrick extends to over 100 feet, 96 feet under "water table," telescoping and folding to less than 60 feet over the vehicle for moving over highways from one well location to another. With a gross structural capacity of 600,000 pounds, there is a 3 to 1 margin of safety to handle 100 ton loads (200,000 pounds) continuously.

The derrick will be an integral part of Franks new Clipper units equipped with a 300 horsepower power plant and capable of servicing the deepest producing wells up to 15,000 feet. The Clipper will drill to 5000 feet (normal capacity) with 3½-inch drill pipe, and is a most economical unit for "slim hole" drilling.

Borg-Warner Corporation Extends Operations to West Coast

Borg-Warner Corporation has extended its manufacturing operations to the West Coast for the first time.

Weston Hydraulics Limited, with its plant in North Hollywood, Calif., has been acquired by Borg-Warner through an exchange of stock and will be operated as a subsidiary. Weston designs and manufactures hydraulic and pneumatic equipment for the aircraft industry.

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giving away your liquids!

Install a Russco Micro-Plant or Super-Knockout

NOW you can hike profits on your gas distillate wells — large or small — with Russco's miniature gasoline plants. Designed to solve your particular problems, the Micro-Plant and Super-Knockout installations are fully automatic . . . require minimum operating attention . . . and can be economically moved from one lease to another.

These miniature absorption and extraction plants operate at either high, medium, or low pressure. Depending on the nature of your well, their highly efficient multi-fractionation processes furnish top recovery of such materials as propane, butane, gasoline . . . and at the same time accomplish dehydration.

Whatever your present production, the Russco Super-Knockout (Low-Temperature Processer) or Micro-Plant (Larger Unit) will step up recovery enough to pay out quickly and give you an excellent profit increase.

For complete service, from design to operation, write or call.—

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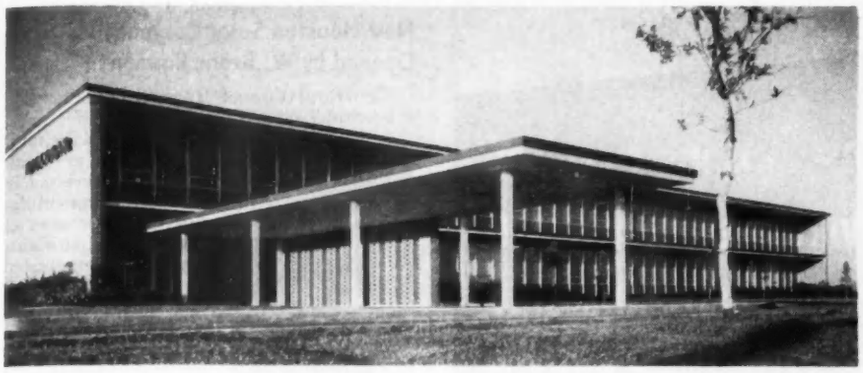


Magcobar Opens New Building

A new office and laboratory building for Magcobar has been completed and formally opened in Houston at 3403 Buffalo Speedway. The building is of lift-slab construction and has an area of 29,360 feet. General and executive offices, a research library and snack bar are in the south wing of the building. Executive offices overlook a landscaped patio. The various laboratories located in the north wing include three labs used for research and development of new products and a field service laboratory equipped with complex instruments for running tests on problems too complicated to be solved by men in the field. The engineer training laboratory serves as a school for Magcobar engineers and serves the oil industry personnel who wish to take advantage of Magcobar's training courses.

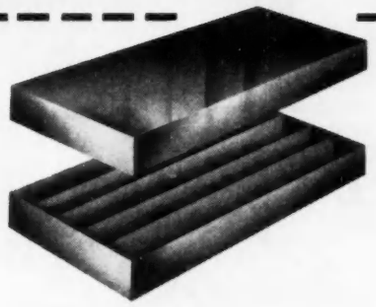
Rockwell Manufacturing To Build Kentucky Plant

Rockwell Manufacturing Company has announced the selection of Russellville, Ky., as the site for a new plant expected to go into operation in mid-1955.

The plant will be located on a 30 acre site, will have from 80,000 to 100,000 square feet of floor space, and is expected to cost from $800,000 to $1 million, exclusive of production equipment. Construction will start in early January and initial occupancy is scheduled during May.

Russellville, located in the south central portion of Kentucky, is the sixteenth community in which Rockwell Manufacturing Company will have plant facilities.

CORE BOXES



Each box holds 10 feet of core, and has following copy on end:
Hole_____From_____
To_____Box No._____
"Project Name" printed on top and bottom of box.

Size	Length		Width		Depth
AX CORE BOX	24	x	8¼	x	1⅜
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NX CORE BOX	24	x	12	x	2¼
SPECIAL 2½" CORE BOX	24	x	13⅞	x	2⅝
SPECIAL ANY SIZE					

Samples available on request. Small shipments made immediately as we carry small stock of all sizes at all times. Write for catalog sheet.

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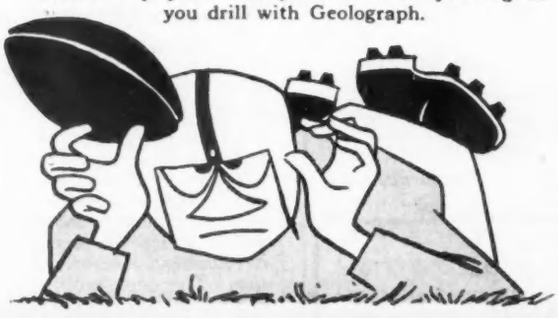
You have *COMMAND* of the situation all the way down to the goal when you take advantage of the timely information supplied by your Geograph. That's why you'll always save when you log as you drill with Geograph.



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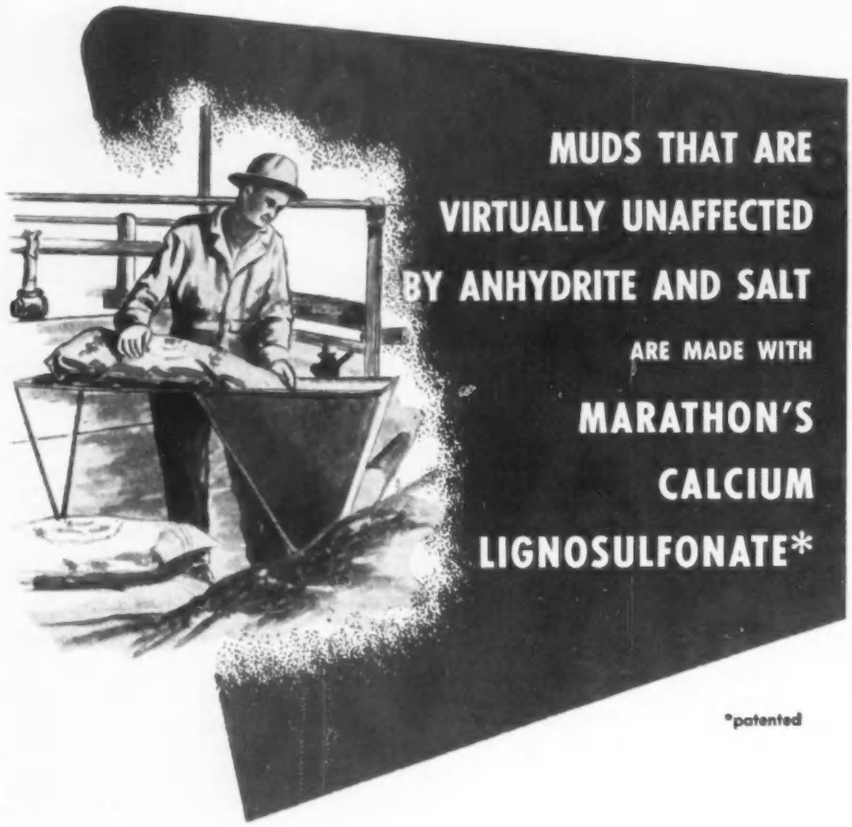

This product, tradenamed LIGNOX†, the only lignosulfonate proved by years of successful drilling, conditions lime treated and oil emulsion muds so effectively that they are virtually unaltered by contaminants encountered in normal drilling, e.g.: gypsum, anhydrite, lime, limey shale, clays, cement and salt.

Marathon's calcium lignosulfonate tends to reduce viscosity, gel strength, and water loss in drilling fluids. Besides being an outstanding dispersant, it is also an excellent stabilizer for water-base emulsions.

Whenever you encounter difficult drilling conditions, switch to a lime base or oil emulsion mud prepared with Marathon's lignosulfonate. It's available in 50 pound multiwall bags.

LIGNOX†
may be obtained from
BAROID SALES DIVISION
NATIONAL LEAD COMPANY
HOUSTON, TEXAS
†Reg. T.M., National Lead Company

MARATHON *Corporation*
CHEMICAL DIVISION
ROTHSCHILD • WISCONSIN

New Houston Sales Company Opened by W. Brant Rawson

The formation of Rawson & Company, a new sales company which will offer sales, service and warehousing facilities to manufacturers interested in the petrochemical industrial trade area of Texas and Louisiana, has been announced by W. Brant Rawson.

W. Brant Rawson

Offices are located in Houston at 1401 San Jacinto. Rawson recently resigned from Maintenance Engineering Corporation of Houston, after being associated with the company since 1927 and having been vice pres dent for the past 12 years. Rawson has experience in the oil, chemical, paper and power industries of Texas, Louisiana and the Republic of Mexico.

Axelson Manufacturing Awards Scholarships to Employes' Sons

Jack H. Gaston of Lynwood, Calif. and David L. Ankeny of Huntington Park, Calif., recently received four-year "work-study" scholarship awards to the University of Southern California. The awards were presented by Dean Herman Scheffield, Director of Admissions and Registration for U. S. C. and Carl Dudding, director of personnel for Axelson. The educational plan is sponsored by the Axelson Manufacturing Company, Division of the Pressed Steel Car Company.

The scholarships are awarded each year on a competitive basis to sons of employes of the Pressed Steel Car Company, Inc. David's father, Don Ankeny, has been with Axelson for ten years, and is a thread grinder in the Gage department. Jack's father, Harold Gaston, is a foreman of the Jacket Lathe department, and an employe for 31 years.

Dow Chemical Company Forms Development Research Section

Formation of a research development section in the Market Research department of The Dow Chemical Company has been announced.

The group's primary responsibility will be to analyze specific industrial fields as a means of forecasting long-range trends and needs of various industries. It will then present such information to Dow research and development groups for use in developing ideas for new company products. The unit will also exchange ideas with development people in the industries being studied.

Heading the new section's activities, now under way in two major fields, are Dr. E. R. Boedeker and T. E. Werkema. Dr. Boedeker, who recently came to Dow from the Houdry Process Corporation, Wilmington, Del., will handle the petroleum industry for the group. He has 12 years experience in this field. Werkema, who has been with the company since 1946, will devote his efforts to the construction industry. He recently transferred to the new group from the physical research laboratory.

Brewster Company Presents Service Awards to 56

Fifty-six employes of The Brewster Company were presented service pins and watches at recent ceremonies in the office of Harry Marioneaux, vice president and general manager.

Gold pins, stamped with the Brewster drawworks crest and the years of service, were received by six 20-year employes and 44 ten-year men and women.

Gold watches, also inscribed with the crest and length of employment, were given to six employes with 20 or more years of service.

The 56 employes who received service awards represent some 800 years of combined experience in the manufacture of drilling equipment.

Among those receiving awards were Mrs. Lessie H. Gardner, Frank W. Tyler, Arthur T. Davison, Thomas R. Hilton, James M. Rains and Arthur L. Norris, who received 30-year pins.

Twenty-year pins and watches went to Mrs. Lillie T. Brewster, Marvin E. Turner, Barney A. Beard, William G. Wardlaw, Elmer J. Turnage and James W. Stockard.

Awarded ten-year pins were Miss Ella A. Hudson, Harry B. Marioneaux, Denton T. Brown, Walter E. Copeland, William C. Mackey, Carl Huddleston, Julian L. Brandon, Leroy J. Boykin, John D. Johnson, Sr., John D. Johnson, Jr., Melvin L. Windham, Arnold E. Haven, Redman C. Adkinson, Willie H. Franks, Jack D. Farmer, Donald L. Calcote, John L. Britt, Ruben W. Edwards, Hugh J. McCrary, Wilbur R. Manis, Francis P. Leadaman, Alec P. Johnson, K. D. Phillips, James J. Sikes, Jim Pillars, Lee A. Jones, James Malone, Leonard Knox, Berttran Nichols, Douglas Thomas, Henry Nash, Earnest Gibson, Lewis Washington, John B. Marshall, Johnnie Brooks, Ira Jackson, Autry Garrett, Herbert A. Harlan, Jr., George Kalmbach, H. P. Patterson, Rueben Gibbs, Samuel D. Woolsey, Willie Martin and Jim McKeever.

Quaker and Pioneer Rubber Merge West Coast Operations

The West Coast operations of Quaker Rubber Corporation and its recent acquisition, Pioneer Rubber Mills, Pittsburg, Calif., will be merged at once under the name Quaker Pioneer Rubber Mills, Division of H. K. Porter Company, Inc.

Quaker Pioneer Rubber Mills will handle all the sales, manufacturing, and service operations of both companies in ten western states. The Pioneer and Quaker sales organizations will be combined in the East and operated under the Quaker Rubber Corporation.

Other divisions of H. K. Porter Company, Inc., include Alloy Metal Wire, Buffalo Steel, Connors Steel, Delta-Star Electric, Leschen Wire Rope, McLain Fire Brick, The Watson-Stillman Company, and Waston-Stillman Fittings.

Republic Supply Distributes American Manufacturing Pumps

The Republic Supply Company of California announces that the firm has assumed the exclusive distributorship in California for the pumping unit line of the American Manufacturing Company of Texas, located at Fort Worth.

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MANAGERS, ENGINEERS, AGENTS, etc. 628 names and addresses and the names of the companies in the book with which they are connected.

BUYERS' GUIDE—A list of Manufacturers of Oilfield and Refinery Equipment and Accessories comprising 875 headings, giving names, addresses and "who makes it" of English, American and Continental Oilfield Equipment companies.

ADVERTISEMENTS—300 of the world's leading oilfield equipment manufacturers and accessory companies advertise their products in the 1954 issue.

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Cooper D. Richards

Charles E. Dyer

Lufkin Foundry and Machine Company announces the appointment of Cooper D. Richards as assistant sales manager with offices at the home office in Lufkin, Texas.

Jack E. Gissler

Prior to this promotion, Richards was district manager at Oklahoma City for eight years. Before that, he was district manager at Great Bend, Kansas, for ten years. Richards was employed by Lufkin in 1936, when he received his engineering degree from The University of Texas.

Replacing Richards in Oklahoma City is Charles E. Dyer, who has been resident manager of the Lufkin Machine Co., Ltd., in Edmonton, Alberta, Canada, since 1949. Before moving to Canada, Dyer was district manager of both the El Dorado, Ark., and Wichita Falls, Texas, offices for one year each, after having worked in Kansas as service engineer for two years. He has been with Lufkin since 1933.

Moving to Canada as resident manager is Jack E. Gissler, who has been employed by Lufkin since 1947. He goes to Edmonton from Witchita Falls where he has been North Texas district manager for the past six years.

•

Roger L. Dailey has been appointed division manager of the Eastern division of The National Supply Company. He succeeds William Van Vleet, who will handle major accounts in the Pittsburgh area.

Roger L. Dailey

Dailey joined National Supply in 1922 as a field salesman in Okemah, Okla. He was appointed assistant district manager of the Illinois district in 1938 and since 1944 has served as district manager of the Illinois and Michigan districts.

The Eastern division, with headquarters at Toledo, includes the Kentucky and West Virginia district, the New York and Pennsylvania district, and the Ohio district, as well as the Illinois and Michigan districts.

•

McCullough Tool Company has announced the opening of a new sales office in Denver with J. M. Edwards in charge, and the appointment of Al Simpson as sales engineer in the Bakersfield, Calif., branch service location.

Edwards joined M. Cullough Tool in 1953 after being associated with Union Oil Company as a geologist. Before his appointment to the new Denver office, Edwards was a logging engineer and geologist in the Los Angeles office.

Simpson has worked as a logging engineer and geologist at McCullough's Los Angeles office since 1950.

•

Mid-Continent Supply Company has announced the promotion of B. O. Giddens from city salesman in Odessa, Texas, to store manager of the company's Eunice, N. M., location.

Giddens worked briefly with Mid-Continent in 1944-45 until he entered military service. He returned to the organization in 1949 at the Sundown, Texas, store and worked there until his Odessa transfer. Giddens has experience with other oil field suppliers in addition to his Mid-Continent service.

WORLD OIL'S Trading Post

CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted ads**, 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 17th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

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NOTICES

■ Want to contact manufacturers of oil field equipment who will require intelligent representation in the Mid-Continent for 1955. We have continuously covered since 1939 and have excellent jobber and consumer clientele. Need an additional line to extend our program. All replies held in strict confidence. Box 48-W, c/o WORLD OIL, Houston, Texas.

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■ ATTORNEY, 36, presently tax attorney with Government, desires position utilizing tax and legal background with corporation in foreign country. Prefer Western Europe, South America or Middle East. Write Box 43-W, c/o WORLD OIL, Houston, Texas.

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SQUEAKS from the BULLWHEEL

"I was the lowest bidding drilling contractor on the West Coast."

The Inside Story

It was Zeb's first trip to the city, and after registering at the hotel across the street from the train station, he set out to see the sights. In the course of his meandering, he passed a pawn shop's display windows and there espied an assortment of pocket watches. Fascinated, he went inside and inquired of the clerk, "Whut's them round things what's got a little stick that goes swishin' around?"

Informed that they were watches, Zeb then wanted to know what they were for.

"They tell you the time," the clerk explained. "Here, just hold it up to your ear and listen, it will tell you the time."

Zeb held the watch to his ear and heard the tic-tic-tic-tic. "Why it sure does" he exclaimed. Completely charmed, he paid the dollar purchase price and left the shop, owner of a pocket watch.

Frequently, as he continued his exploring, he would pause, pull out the watch, and ask "Whut time is it?" Then he would hold the watch to his ear, and listen to the reassuring tic-tic-tic-tic. "That's whut I thought," he'd say, entranced by the consistency and accuracy of the watch.

Weary, he returned to his hotel room and retired. First thing on awakening the next morning, Zeb rushed to the dresser and picked up the watch. "Whut time is it?" he asked eagerly. This time there came no tic-tic-tic-tic. Alarmed, Zeb screamed again, "WHUT TIME IS IT?" But still no sound from the run-down watch.

Furious, Zeb threw the watch to the floor, and with the heel of his heavy boot stamped it. The face of the watch shattered, cogs flew out, springs unwound, pins crumbled, wheels rolled around the room. Aghast, Zeb surveyed the ruins, and trembling, he blurted out an apology, "Ah'm sorry. Ah never would of done it if Ah'd knowed you was going to be a mother!"

•

One Little Vice

She: "No, I don't smoke, drink or neck."
He: "Well, then, what do you do?"
She: "I tell lies."

•

Diplomacy

That a certain young man was wise beyond his years was proved when he

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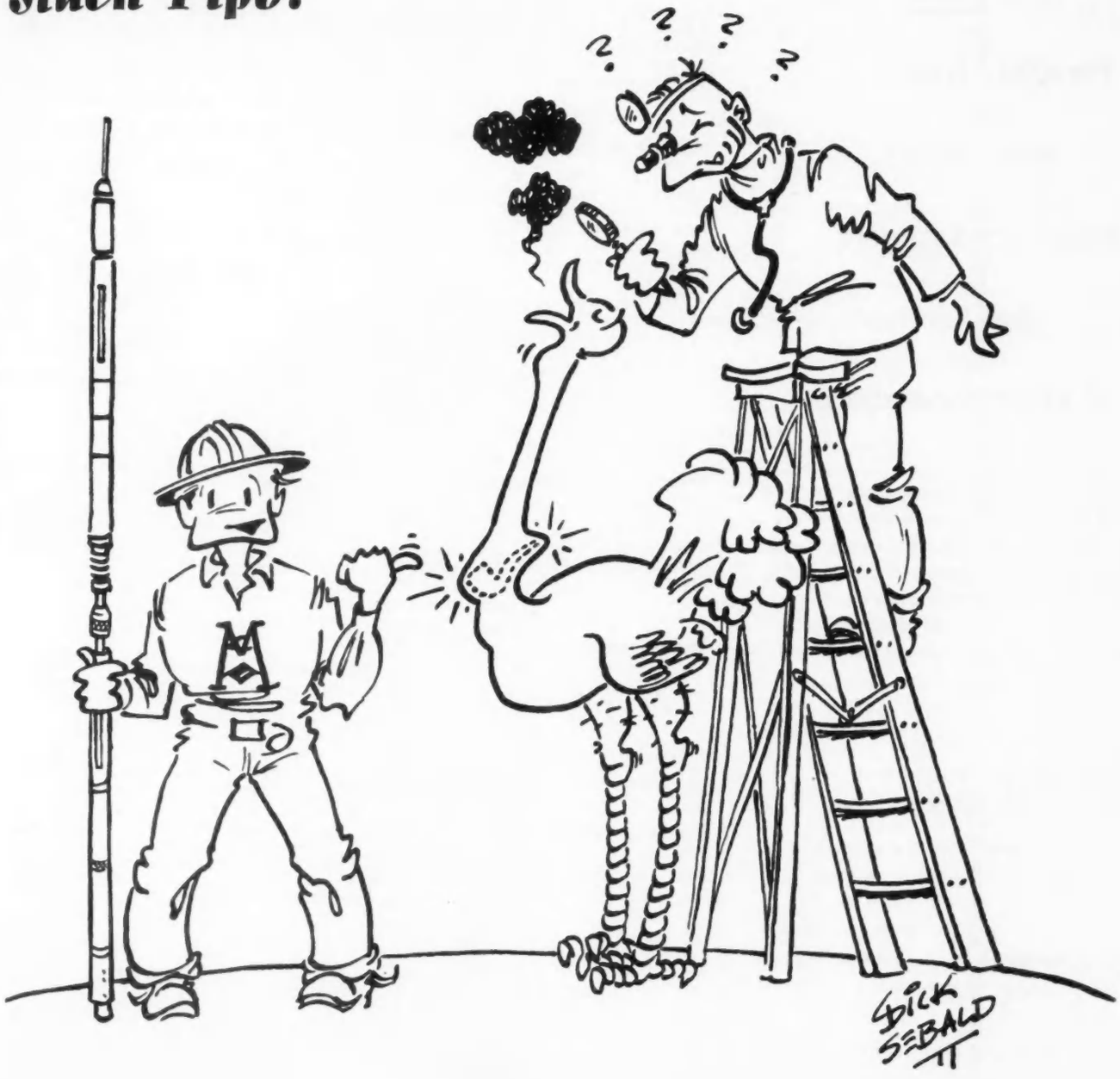

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paused before answering a widow who had asked him to guess her age.

"You must have some idea," she said.

"I have several ideas," he answered with a smile, "the only trouble is that I hesitate whether to make you ten years younger on account of your looks, or ten years older on account of your intelligence."

•

Honest Mistake

Two little boys . . . twins . . . were walking to school one morning when one of them tripped and fell. The other lad went ahead to school and was just seating himself in the classroom when his teacher asked, "Where's your brother, Jimmy?"

"Up the street, where he fell," Jimmy said.

The teacher ran out, found the injured boy and carried him into the schoolroom. "Why, Jimmy — his ankle's broken!" she cried. "Why on earth did you leave him?"

"Well, gee—I thought he was dead."

•

What Comes Naturally

"I never heard one man talk so fast in all my life."

"Why shouldn't he? His father was a tobacco auctioneer and his mother was a woman."

•

Theory vs. Practice

"Well," said the candidate, "how did you like my speech on the agricultural problem?"

"It wasn't bad," agreed the farmer, "but a day's rain would do a heap more good."

•

Home Is Where the Warden Is

Two days after a big party, two friends met on the street. "Well, old man," said one, "how did you get along after I left you the other night? Did you get home all right?"

"No," was the reply. "A cop saw me and put me in jail for the night."

"You're sure lucky," said the first. "I got home."

•

"and we punch out and in for coffee breaks here, son!"

This Is People?

A six-year-old girl submitted the following composition on "people" to her teacher:

"People are composed of girls and boys, also men and women. Boys are no good at all until they grow up and get married. Men who don't get married are no good either. Boys are an awful bother. They want everything they see except soap. My ma is a woman, and my pa is a man. A woman is a grown up girl with children. My pa is such a nice man that I think he must have been a girl when he was a boy."

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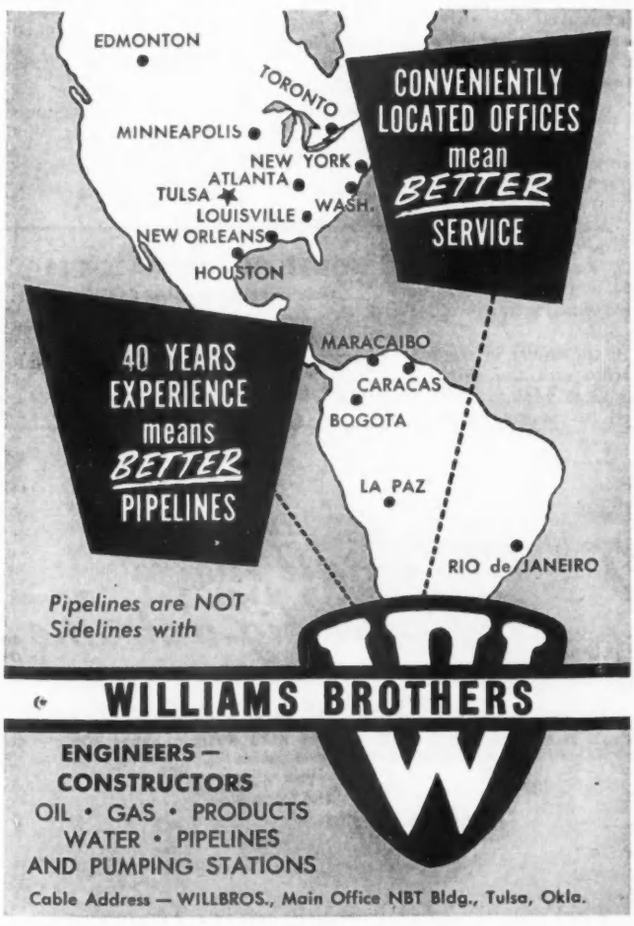

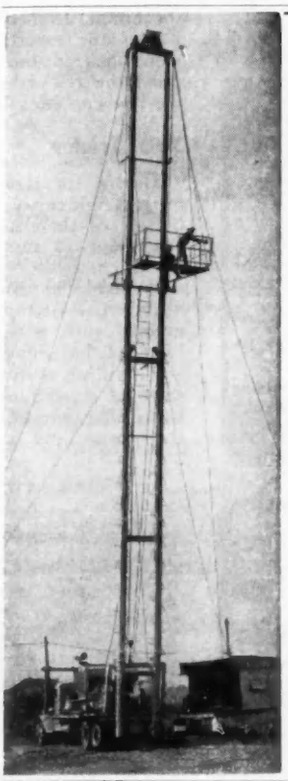

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The complete assembly includes the (1) poles, (2) breakdown shaft assembly, (3) attached racking platform (which positions itself when poles are raised), (4) pole adjusting screws, (5) a sheave assembly to be mounted on truck or trailer for raising the poles, (6) and a four or five 24 inch sheave crown block for ⅞" line.

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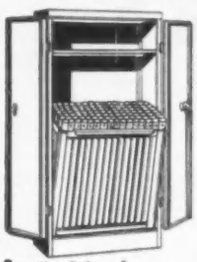
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"Would you mind making it gush for him?"

Careful, Boy!

Five-year-old Jimmy was walking along the street with little Betty, four. As they were about to cross the street, Jimmy remembered his mother's teaching.

"Let me hold your hand," he offered gallantly.

"Okay," replied Betty, "but I want you to know that you're playing with fire."

•

After You, My Dear Alphonse

A man fell overboard from a Caribbean liner and screamed for help as he saw a school of man-eating sharks heading his way. A famous criminal lawyer called from the steamer, "I'll help you," and dove into the ocean. Immediately the sharks formed a two-lane escort and convoyed the two men back to the ship. "It's a miracle," cried the rescued man. "Not at all," said the lawyer. "Merely professional courtesy."

•

Too Tricky

During the long evenings at sea sailors on a freighter were frequently entertained by one of their number, a sleight-of-hand performer of no mean ability. His act, in which cards, money and handkerchiefs were made to disappear, was enjoyed by all aboard—except one—a parrot which greeted each performance with a raucous "Ha, ha, ha! Phooey!"

The ninth night out, in the midst of the show, a terrific storm arose and the ship sank. The prestidigitator was blown into the ocean and managed to grasp some wreckage to support his weight.

The following morning, he was startled to see his critic, the parrot, sitting on an upright on his improvised raft. Not a word passed between the castaways for two days. Suddenly, however, the parrot looked down, cocked his head to one side, and with a gleam in his eye, demanded: "All right, what'd you do with the ship?"

•

Faith

Faith is that quality which lets you eat blackberry jam on a picnic without looking closely to see if the seeds move.

•

Eager to Serve

Young man to draft board: "But you can't turn me down — I've proposed to three girls, told my boss what I think of him, and sold my car!"

•

He Tried

"So," sobbed Ilma Kropotkin Vasilynikovitchsky, "Ivan Ninesporsky died in battle. Did he really whisper my name with his dying breath?"

"He did his best, lady," was the reply. "He did his best."

•

Let's Eat

"You're sweet enough to eat," he said in accents warm and low; "I do eat," said the sweet young thing, "Where do you want to go?"

•

Now, Julius

Two inmates of the asylum were talking together.

"I've made up my mind," blurted one suddenly, with a fixed look of decision on his face. "Tomorrow I order my legions to invade England. History will never say that Julius Caesar faltered in pursuing the Britannic campaigns."

"England, eh?" mused the other thoughtfully. "Well, Julius, if I were you . . . and, incidentally, I am . . . "

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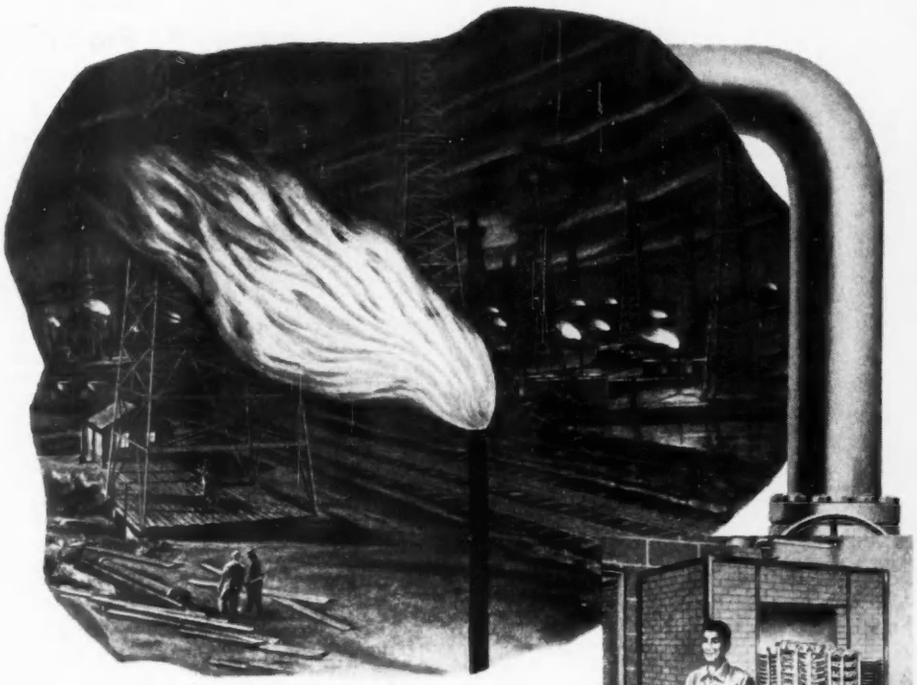

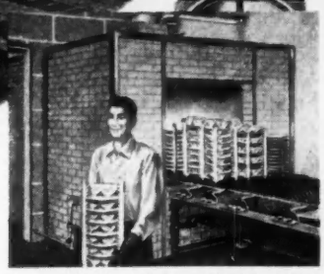

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What's New in Equipment

Drilling • Production • Exploration

Floating Foundation

To overcome the big problem of water-soaked logs, cracked or rusted pontoons of a marine float the Pointer-Willamette Company of Edmonds, Wash., has developed a molded fiberglass pontoon, or floating foundation. The life expectancy of this type floating foundation is not known, but Navy people believe that 20 years without any attention is a conservative estimate.

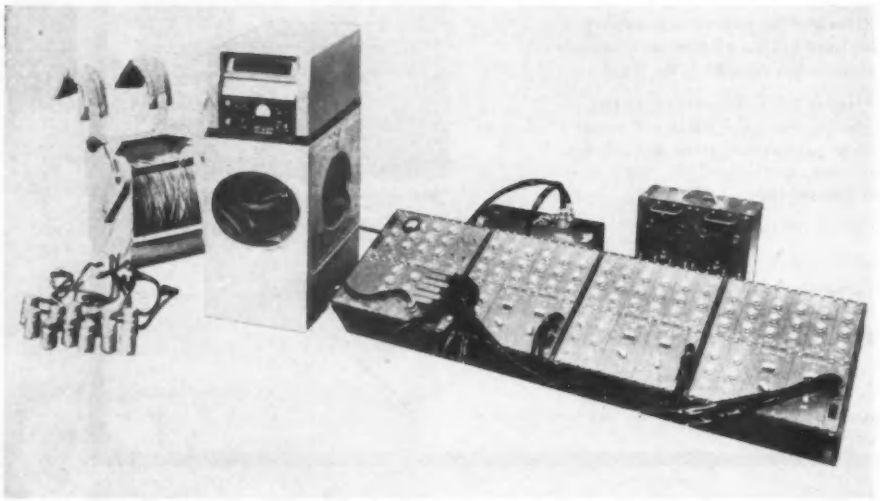
The feather-ride marine float makes use of the new type floating foundation in a completely engineered, prefabricated marine structure. The marine float sections are available in one length, 16 feet, but in four different widths, 4 feet, 5 feet, 7 feet, and 9 feet. These sections will fit together end to end, side by side, end to side or in any manner to make a complete float any size or shape.

The new feather-ride prefabricated marine floats are available through marine dealers and are shipped from the factory knocked down. Assembly is easy with all hardware, treated wood sections and floating foundations furnished. They are light in weight, a 4-foot by 16-foot section weighs as little as 530 pounds, which means it can be assembled on shore if desired, picked up by four men and carried to the water.

The number of feather-ride floating foundations under a float section may be varied to accommodate different freeboard conditions. For instance, the smallest type (4 feet wide by 16 feet long) is supported by two feather-ride floating foundations. It has 12 inches of freeboard and each 100 pounds of load reduces the freeboard by only 1¼ inches. The same size float with four feather-ride floating foundations has 16¼ inches of freeboard, reduced by only five-eighths-inch with each 100 pounds of load. Freeboard may be adjusted to any desired height through the use of either sand or water ballast in the feather-ride floating foundations.

The deck of the new feather-ride marine floats is of double laminated 1-inch by 12-inch chemically treated to resist deterioration from salt or fresh water. All the hardware is galvanized to prevent rust.

For more data circle **No. E1** on Readers' Service Card, last page this issue.



Seismic System

A complete new seismic system with exceptionally wide dynamic range has been announced by Houston Technical Laboratories. Called the Model 7000 seismic amplifier system, it is a high gain, low distortion system specifically designed for magnetic recording as well as conventional seismic applications.

The HTL 7000 system incorporates three automatic gain control speeds with a one million to 1 AGC control range. In addition to AGC operation, it also may be operated on constant gain or time varied gain. Total system gain is over 120 decibels, with input range from 0.1 microvolt to 0.1 volt between 10 and 200 cycles. Great flexibility in filtering is provided by an unusually large number of useful filter settings, totalling 1380.

Yet even with this extreme sensitivity and flexibility, the 7000 system is a portable field instrument because of lightweight unit construction. New exclusive features and the features formerly found only in heavy, truck-mounted seismic amplifiers have been incorporated into the 7000 system.

Module design and lightweight construction limit maximum weight of any one element to 57 pounds, with the 50-trace recording oscillograph weighing only 41 pounds. Aluminum and magnesium are used extensively and components are equipped with carrying handles or optional back-pack adapters.

For more data circle **No. E2** on Readers' Service Card, last page this issue.

Teflon Filters

Porous Plastic Filter Company has announced the availability of porous teflon filters. Teflon is the chemically inert, high temperature plastic produced by Du Pont. By using a sintering and molding process without the aid of any additives or plasticizers, porous Teflon filter medium is being produced which has all the outstanding

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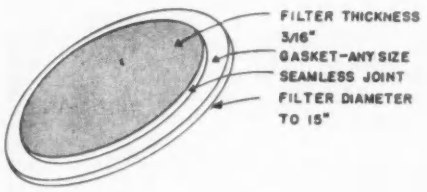


corrosion resistance and temperature stability properties of solid Teflon.

Porous Teflon has a mean pore size of nine microns and will filter out of liquids all particles having diameters larger than three microns. In gas filtration all particles as small as one micron will be removed. Flow capacities as high as 45 gallons per minute per square foot of filter at five pounds per square inch differential pressure can be anticipated for organic fluids of 1 centipoise viscosity. This product makes possible the filtration and dispersion of all liquids and gases, thus presenting a universal filter medium suitable for use with all commercial acids, caustic and organic solvents including such severe corrosives as fuming nitric acid, acid, aqua regia and hydrogen peroxide.

For more data circle **No. E3** on Readers' Service Card, last page this issue.

DRILLING

Diesel Engines

The new line of General Motors series 567-C diesel engines is now available for industrial and petroleum applications through Stewart & Stevenson Services, Houston.

This diesel can now be furnished by Stewart & Stevenson in 600 to 1750 horsepower to meet the ever-increasing demands of the drilling industry for more flexible, higher horsepower with maximum fuel economy and long life.

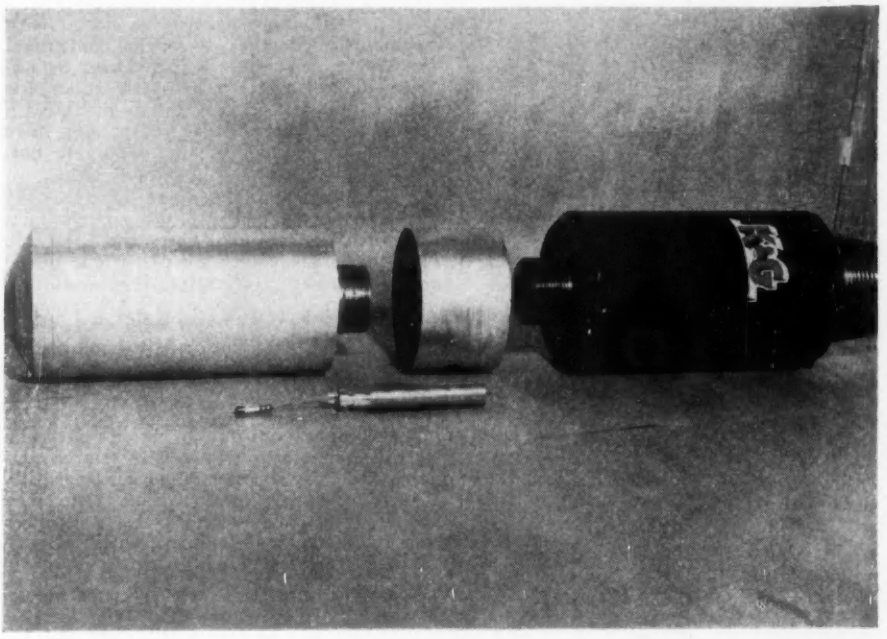
A V-type cylinder arrangement is used in the design of the series 567-C, permitting the application of the engine where space requirements are limited. This design also insures long life by the use of a short, sturdy crankshaft with rigid stress members. Use of the GM unit injection system combined with a system of balancing makes possible maximum fuel economy at speeds from 350 revolutions per minute to 835 rpm.

The uniflow scavenging principle is used to permit high horsepower output with a minimum weight since the engine delivers power on every downstroke of the piston. Weight for the basic engine is as low as 20 pounds per horsepower.

The Model 567-C can be furnished with equipment for dual fuel operation on either diesel fuel or natural gas. It is designed to go from dual fuel operation on natural gas automatically over to straight diesel operation if the gas supply is shut off.

(This item supplements Stewart & Stevenson Services, Inc., data on pages 4837-4842 of the Composite Catalog, 20th Edition.)

Fore more data circle **No. E4** on Readers' Service Card, last page this issue.



Drill Pipe Junk Shot

The K & G drill pipe junk shot, Type A-100, offers the oil industry an aid in cleaning up wells which otherwise would have to be abandoned or side tracked. It is recommended for use in wells where iron or steel junk has been lost, which cannot be recovered by ordinary fishing methods. Such items as complete rock bits, large slips, etc., can be quickly broken up with the shot, then recovered from the well bore with a K & G magnetic fishing tool.

The shot, run in the well on drill pipe, is made up of an upper steel sub, which screws directly into the drill pipe or drill collar and a lower expendable body constructed of aluminum. The upper steel body is provided with fluid circulation ports and the lower expendable body houses the powerful "shaped" charge. An electrical blasting cap detonates the main charge. The blasting cap is detonated by means of an electrical go-devil, lowered inside the drill pipe on a small measuring line after the shot reaches bottom. There are no chances for premature explosions. When the shot is fired, its major force is directed straight down toward the target. The force of the explosion is sufficient to break up a large rock bit or other heavy steel object.

The outstanding feature is the ease with which it can be accurately located in the well in relationship with the fish to be broken up. Since the shot is run on drill pipe and can be circulated until it rests upon the fish, the fish always receives the maximum force of the explosion. Another feature of the tool is its portability. The steel sub and aluminum shot housing are both small and can be carried in an automobile or airplane.

The explosive used in the shot is the safest type available for use in work of this nature. The shot is transported without the blasting cap being in place and the cap is not placed in the shot until prior to lowering it in the well.

This new type K & G shot has a more rugged body than the earlier models, which allows it to be used in crooked holes without the danger of its being damaged before reaching bottom.

(This item supplements K & G Oil Tool and Service Company, Inc., data on pages 2589-2591 of the Composite Catalog, 20th Edition.)

For more data circle **No. E5** on Readers' Service Card, last page this issue.

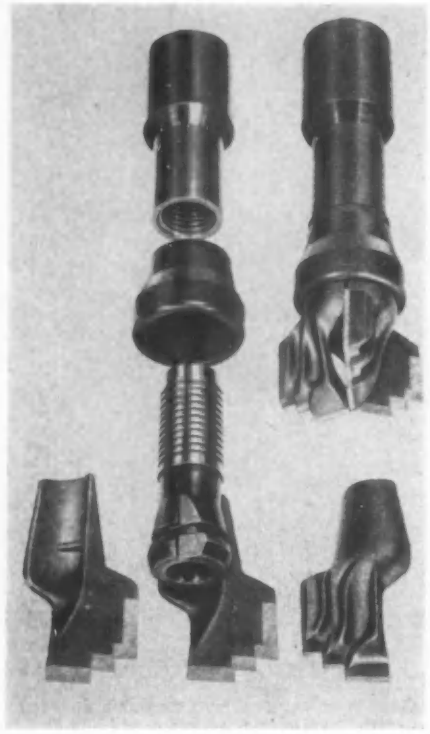
Blade Insert Bit

A new insert rock bit designed to improve the efficiency of rotary drilling in seismic exploration has been developed by Herb J. Hawthorne. Known as the Hawthorne insert rock bit, the new bit has undergone rigid field and laboratory testing, and has demonstrated a capacity to drill efficiently 95 percent of all formations encountered in seismic exploration drilling.

The Hawthorne insert rock bit is made of tough tool steel and utilizes a special quality of tungsten carbide inserts on the cutting surfaces of the bit. High toughness of these inserts minimizes breakage and a special welding process developed by Hawthorne prevents loosening of the inserts while drilling. A unique dressing procedure on the blades produces a superior cutting edge, which permits the bit to stay sharp while drilling the harder formations. An improved water-course in the bit for flushing out cuttings assures faster penetration and cleaner hole.

Like all Hawthorne bits, these insert bits were developed on Hawthorne's patented interchangeable, replaceable blade design, permitting the use of many sets of blades with the same bit body. After the blades have been worn away, they are discarded and easily replaced, providing the driller with factory controlled "on-the-drill" bit service.

Hawthorne insert rock bits are available

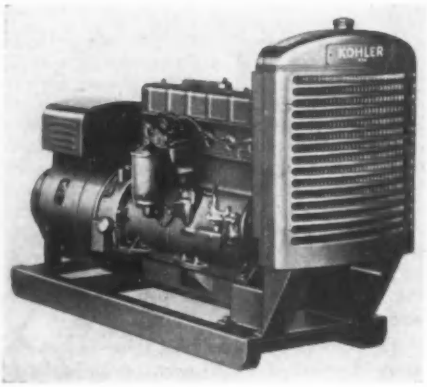


in 4¼, 4½ and 4¾-inch Type "AC" blade sizes, and 3½, 3⅞, 4, and 4¼-inch Type "DB" blade sizes, with the adapter sub into which the bit shank screws available with box or pin connection to fit any available drill rod or drill collar.

(This item supplements Herb J. Hawthorne Company, Inc., data on pages 2350-2351 of the Composite Catalog, 20th Edition.)

For more data circle **No. E6** on Readers' Service Card, last page this issue.

PRODUCTION



Electric Plant

A new 15 KW gasoline-powered AC electric plant has been put into production by Kohler Company. Available in six different models with remote control or stand-by starting, and with varying voltage outputs, the new plant is water cooled with a large radiator, belt-driven centrifugal pump and blower fan. It features an adjustable jet carburetor with automatic choke and a mechanical fuel pump with oil bath air filter. A carburetor and valve kit for converting the fuel supply to natural of artificial gas is available.

The six cylinder engine produces 51 horsepower at 1800 revolutions per minute and has a 3½-inch bore and 3¾-inch stroke. Intake valves are of chrome nickel and exhaust valves of chrome-silicon. Pistons are of an aluminum alloy. There is a forged steel crankshaft with three main bearings and lubrication is a combination of pressure feed, metered intermittent jet and spray.

Remote starting of the new Kohler plant is accomplished through an on-off switch on the plant or by a two-wire remote control. Stand-by starting, which automatically starts the plant and transfers the load whenever regular service fails, is through an emergency transfer panel with a 75-amp built-in transfer switch.

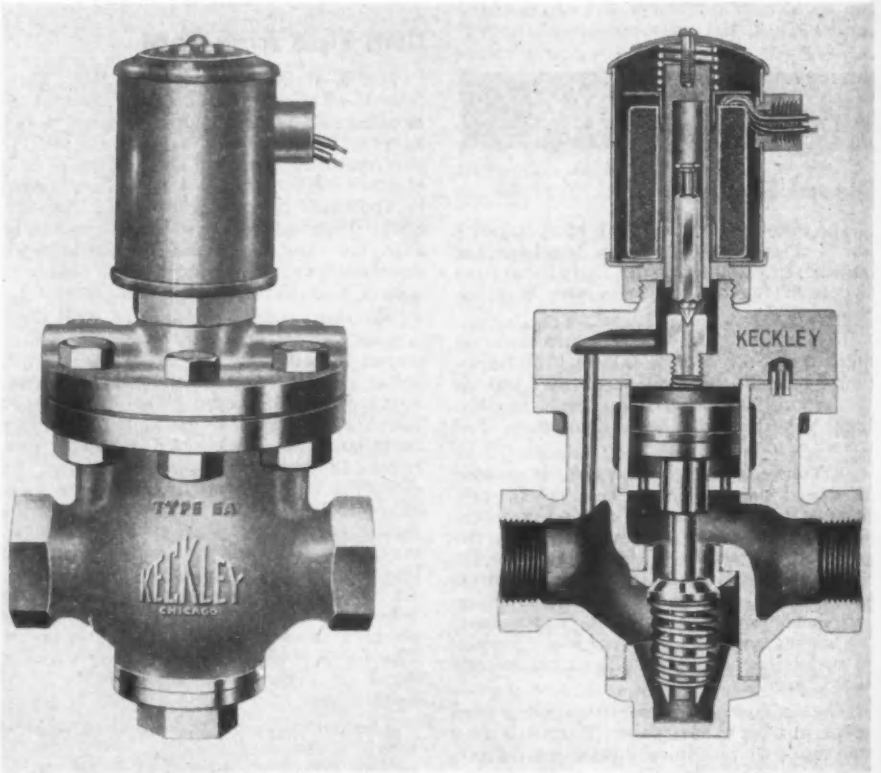
For more data circle **No. E7** on Readers' Service Card, last page this issue.

Thread Compound

"Big 'D' Dope," lubricant-seal for all types of threaded fittings, guaranteed to afford savings in excess of 70 percent on materials and manpower, has been developed by C. H. Dragert Company. A single application of this thread compound provides permanent lead-plating, island high, permitting repeated, easy, quick assembly and disassembly of any size threaded connections without re-doping and without damage to threads. The product has passed the most rigid tests as a lubricant-seal for aircraft and marine equipment; hydraulic lines; drill pipe and tool joints; nuts and studs on all types of pumps and engines; large plug valves; fork-lift and elevator guide channels; heavy, open-worm gears; line grooves on sheaves; and as a packing sealer and steel cable lubricant.

The compound is warranted anti-gall, non-corrosive, non-hardening and leak-proof and resistant to steam, gas, oil, air, chemicals, alkali, acids, ammonia and all hydrocarbons, under the most punishing pressures, temperatures and vacuums.

For more data circle **No. E8** on Readers' Service Card, last page this issue.



Solenoid Valves

Type EA, a new line of pilot-operated solenoid valves developed by O. C. Keckley Company is designed for steam service at pressures to 250 pounds or air, water, oil and gas service to 600 pounds. Sizes are one-half-inch through six inches. Valve bodies are bronze or semi steel, pilot valve, main valve and seat are stainless steel. Teflon seat rings for both pilot and main valve seat are available for positive shut-off on air, gas and water service. Solenoid coils are glass insulated heavy duty, moisture-proof type for high temperature and pressure service.

All wearing parts of pilot valve and main valve are readily renewable. The main valve body and parts are identical to and interchangeable with those of standard Keckley pressure and temperature regulators, providing an economic advantage to users.

In operation, the main valve opens when the solenoid pilot valve opens, admitting pressure to the top of the main valve piston. When the pilot valve closes, pressure above the piston relieves, allowing the main valve to close.

For more data circle **No. E9** on Readers' Service Card, last page this issue.

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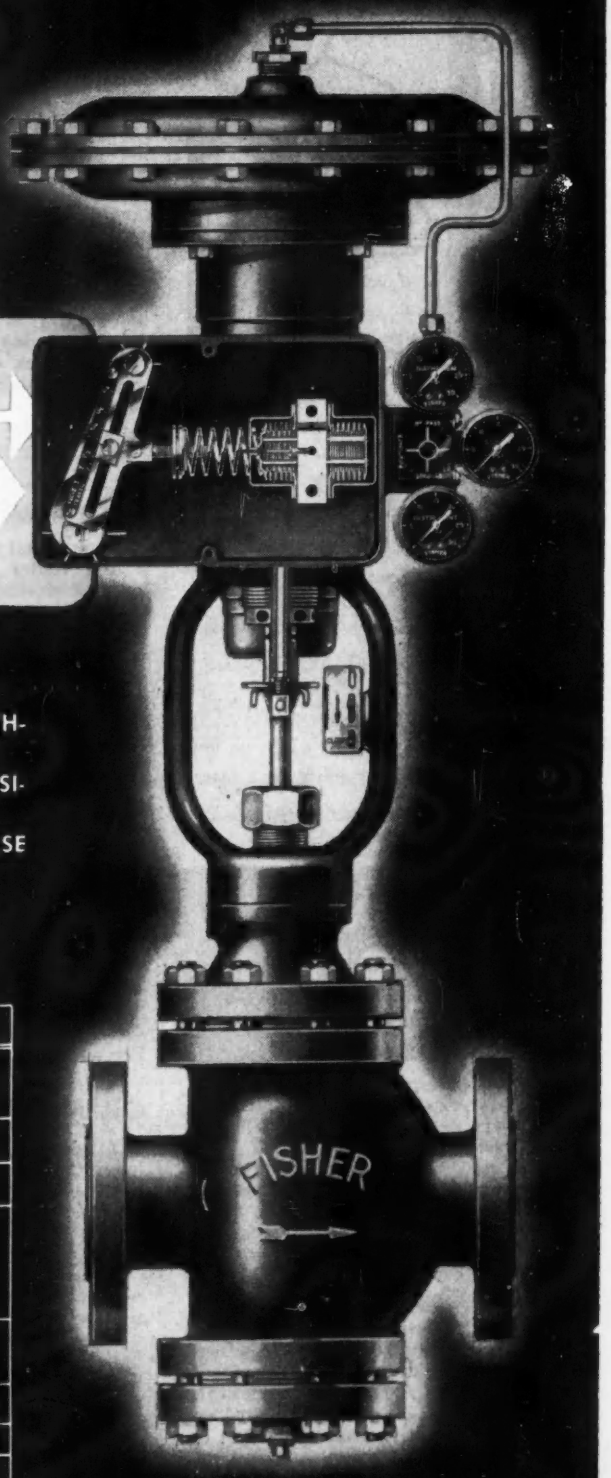
FISHER®

POSITROL®

FOR ACCURATE POSITIVE VALVE POSITIONING

TENS OF THOUSANDS IN USE



FEATURES

- COMPACT — SIMPLE RUGGED
- 5 YEARS FIELD SERVICE
- EASILY ADJUSTABLE
- FORCE BALANCE TYPE OF POSITIONER
- AVAILABLE WITH OR WITHOUT BY-PASS
- USABLE AS REMOTE POSITION INDICATOR
- FOR DIRECT OR REVERSE ACTION VALVES

TECHNICAL DATA

TEST			FISHER TYPE 3500
INSTRUMENT PRESSURE SENSITIVITY CONTROLLING PRESSURE CHANGE NEEDED TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM			0.07 LB.
STEM MOVEMENT SENSITIVITY AMOUNT STEM CHANGE TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM	½" TRAVEL		0.0037" AVE.
	2" TRAVEL		0.015" AVE.
SPEED TIME IN SECONDS FOR FULL TRAVEL	SIZE	TRAVEL	
	DD	¾"	1.2 — 1.2 SEC.
	FF	1½"	4.2 TO 4.8 SEC.
	GG	2"	7.2 SPC TO 9.6 SEC.
	HH	2"	10.5 TO 12.6 SEC.
LAG ERROR IN POSITION AT 9 LBS. CONTROLLER PRESSURE	½" TRAVEL		0.0006" AVE.
	2" TRAVEL		0.001" AVE.
EFFECT OF VARIATIONS IN AIR SUPPLY PRESSURE	½" TRAVEL		0.1 LB. PER 5 LB. CHANGE
	2" TRAVEL		0.1 LB. PER 5 LB. CHANGE
CHARACTERISTICS CONTROLLED P VS DIAPHRAGM P			LINEAR
COMMENTS			STABLE ADJUSTMENTS ALL EASY AND SIMPLE
AIR CONSUMPTION NORMAL 9 LBS. DIAPHRAGM PRESSURE			15.0 CU FT/HR

FOR COMPLETE DETAILS WRITE FOR BULLETIN E-3500.

FISHER

GOVERNOR COMPANY

Marshalltown, Iowa

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE CONTROL

Since 1880

CUT STUCK SAND LINES INSIDE TUBING

KINLEY SAND LINE CUTTER

M. M. Kinley Company Licensees

ABILENE, TEXAS
Hudson-Eads, Inc. - - - - - - - - - - - - - 2-5331
CORPUS CHRISTI
Tubokut Wireline Services - - - - - - - - 5-1811
Wireline Specialties Co. - - - - - - - - - 3-2196
HOBBS
Horne Well Service Co. - - - - - - - - - - 3-5396
HOUSTON
Adair Service Co. - - - - WE-6497, HU 6-3462
MIDLAND
Luccous - - - - - - - - - - - - - 4-8471, 4-4320
PETTUS, TEXAS
Edward N. Jones - - - - - - - - - - - - - - 16
OKLAHOMA CITY
Rainbo Service Co. - - - ME 4-2131, ME 2-3045
WICHITA FALLS
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POSITIVE CORROSION PROTECTION

Capital investment losses of costly equipment can now be controlled by the newly perfected Lambco Chemical Proof Enamel.

This new and amazing coating resists the destructive effects of nitric acid, picric acid, hydrochloric acid, brines, alkalies, refinery crudes, detergents and even a 50% solution of sulphuric acid.

Brushes or Sprays . . . Lambco Chemical Proof Enamel can be brushed or sprayed. Dries dust-free in 30 minutes and can be re-coated in 4 to 6 hours. Lambco Chemical Proof Enamel is easily applied on new or previously coated surfaces.

A Lambert Corrosion Engineer is as close as your telephone . . . just call our nearest office collect.

LAMBCO
CHEMICAL PROOF ENAMEL
A Product of
LAMBERT CORPORATION
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Harlingen • Oklahoma City

New Equipment Literature

Swivel Literature

A new colored descriptive bulletin covering the Emsco HT and HT small size high pressure and high temperature ball-bearing swivel fittings is being offered by Emsco Manufacturing Company. The sales bulletin describes the method of construction and application of these fittings, which range in size from three-eights inch to one inch and from working pressures of 6000 psi at 225 degrees to 1250 psi at 750 degrees. It gives complete dimensions, specifications, weights, and other engineering data. It is illustrated with many sectional drawings, and clearly shows the various types of packing for steam, hot water, oil, liquified petroleum gases, chemicals, etc.

To get a copy, circle **No. E10** on Readers' Service Card, last page this issue.

Expanded Metal Gratings

Penn Metal Company, Inc., has issued a new folder describing its lightweight, low-cost gratings of expanded steel plate. Included are tables of sizes, weights and dimensions. Deflection tables give the load in pounds for various spans. Descriptions and illustrations of the different meshes are also included, as are a few application photographs.

For more data circle **No. E11** on Readers' Service Card, last page this issue.

Ball and Seat

Harbison-Fischer Manufacturing Company has published an eight-page booklet describing its new DuMore ball and seat for sub-surface pumps.

DuMore is an alloy that approaches the hardness of tungsten carbide. The new valve is corrosion-proof, non-magnetic, and unaffected by high temperatures.

To get a copy, circle **No. E12** on Readers' Service Card, last page this issue.

Oil Well Pumping Starter

A new oil well pumping starter featuring a gasketed enclosure and ventilated overload relay compartment has been announced by the General Purpose Control department of the General Electric Company.

The starter enclosure is sealed with a neoprene gasket to prevent entrance of dust or rain, but at the same time, a separate ventilated overload relay compartment helps prevent relays from tripping due to heat from the sun. An external reset button permits resetting relays without opening the sealed main starter enclosure.

The timer on the new oil well pumping starter is designed for programming on a 24-hour basis. Also available is a sequence restarting timer for staggering the return of wells to service after power shutoff. The program timer door permits setting timer without exposing the operator to possible electrical shock, since the main starter enclosure can be padlocked, leaving only the program timer accessible.

Short circuit protection is available in either circuit breaker form, or by a fusible disconnect switch. Built for all-weather operation, the new starter has a baked-on enamel finish over a phosphate-treated base that prevents rust from surface scratches from spreading, according to G. E. engineers.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Drilling Equipment

A new bulletin on the products for the drilling industry produced by Varel Manufacturing Company is available. The publication includes specification and prices of blade type bits for the exploration and geophysical industry, drilling bits for exploration and geophysical activities, rotary rock bits for the drilling industry and rotary rock bits for quarry drilling. Each price sheet is accompanied by an illustrated description of the equipment and its operating features.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Production Equipment Catalogs

Black, Sivalls & Bryson, Inc. has announced publication of three new catalogs on oil field production equipment. Catalog 31-11 describes the company's low pressure vertical free water knockout, suitable for processing wellstreams containing sand and sediment. Catalogs 32-21 and 32-27 on the BS & B series "70" direct heaters and vertical volume heaters describe units that are used principally for heating wellstreams prior to entering flow tanks or for thermo-siphoning settled water in flow tanks. Each heater catalog includes a section on how to size the particular heater and works out a hypothetical problem.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Steam Trap

Sarco Company, Inc., is distributing a brochure on the new Sarco thermodynamic steam trap which has only one moving part, a solid stainless steel disc that practically lasts forever. There are no other moving parts to wear out or cause trouble. Condensate, air and steam act directly on the disc valve which opens to discharge condensate and air—snaps shut to contain steam. No mechanical devices are required to operate valve. The bulletin illustrates five different traps made by Sarco.

To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

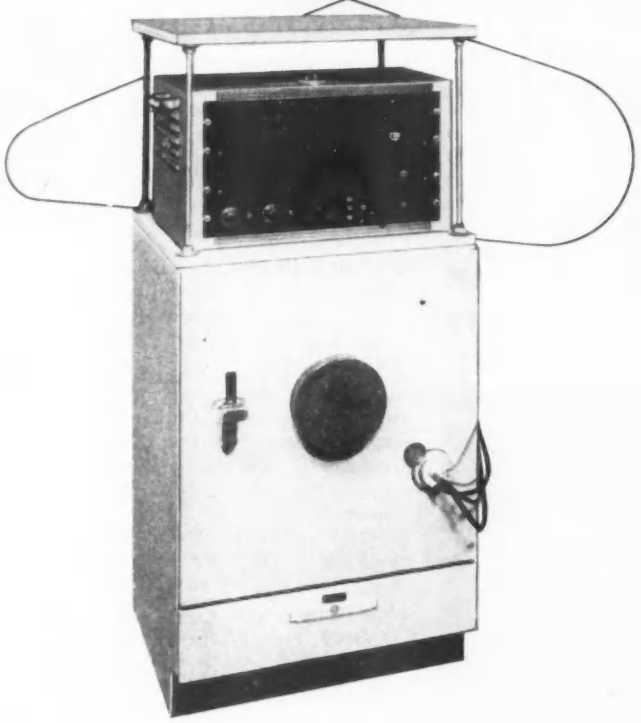
Centralizers

Larkin Packer Company, Inc., has prepared and has ready for distribution a four-page folder on centralizers. The folder discusses the 20 types and four ranges available. It also includes complete selection and price data.

To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Circle numbers on Readers' Service Cards, last page this issue.

LIQUID SCINTILLATION DETECTOR



Tracerlab's unique CE-1 Liquid Scintillation Detector is designed primarily for counting samples of low energy beta emitters such as C-14 and Tritium, which can be prepared in liquid form. Efficiencies of approximately 75% for C-14 and 20 to 25% for Tritium can be obtained with this unit. The total sample volume is 50 cc and sample preparation is extremely simple.

An extremely low background of only 200 to 250 CPM is obtained by refrigeration of the phototubes, use of a dual-channel coincidence amplifier which passes only pulses which occur at the same time, and an overpulse rejection circuit. The two photomultiplier tubes with preamplifiers and a scintillation cell are mounted inside a lead shield in a small refrigerator. Samples may be stored in the dark before counting and a glove port permits transferring samples without exposure to light.

Booklet TL 59 contains complete details and will be sent upon request.

Tracerlab INC
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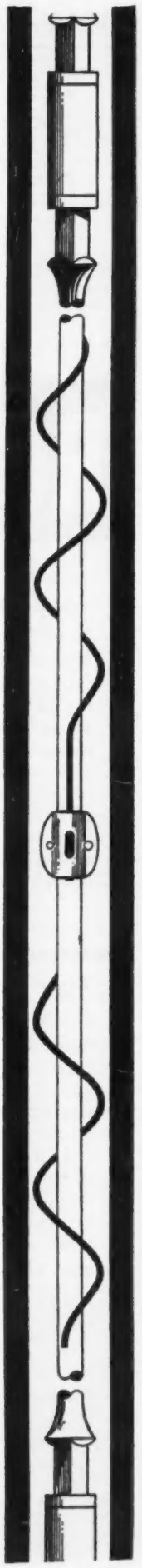
Is Paraffin Your Problem?

There is no problem of paraffin in pumping wells equipped with the Besse Paraffin Remover-Homogenizer. Below is an excerpt from an actual report on two years of use in the Slaughter Field, Cochrane County, Texas:

". . . these paraffin removers offered no difficulty going into the hole or coming out. They centered in such a way that we were able to run the rods at the usual speed. Each clamp was where we had placed it *two years before.*

"We have experienced *no paraffin trouble at all.* We found no accumulation of paraffin either on the rods, the walls of the tubing or on the removers themselves. *All paraffin* had been pumped out with the oil . . ."

BESSE
PARAFFIN REMOVER-HOMOGENIZER
PATENT PENDING



You can get the same results in your wells.

Switch now to Besse Paraffin Remover-Homogenizers at your supply store. Keep them ready at the lease house for immediate use. Any field hand can install them. No special tools are required.

for the best use BESSE and put an end to your paraffin problems!

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New Books, Maps and Movies

FOREIGN OIL AND THE FREE WORLD, Leonard M. Fanning, McGraw-Hill Book Company, 327 West 41st Street, New York. $6.

The author presents a human interest story of the increasing dependence of the U. S.—no longer self-sufficient in petroleum—upon foreign oil. In the Middle East and elsewhere, Americans have been in the forefront of a global revolution in oil. What these changes are and what they mean to the U. S. and the free world in terms of economic and military security is the central theme of this non-technical account. Of particular interest is the story of a private Point Four program—how foreign oil operations enable underdeveloped countries to help themselves.

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THE WILLISTON BASIN, Emory N. Kemler and W. D. Lacabanne, Summary Reports, P. O. Box 176, Spring Park, Minn. 1954. $12.

This book represents a compilation of information on many aspects involving the past and influencing the future development of the Williston Basin. The authors have given the sources of the information both to give credit to those who have contributed to the Williston Basin literature and as a reference to those desiring additional information. Many aspects are covered—among them are general geology of the basin, area geology, exploration, drilling practice, production, pipe line and refining in the area.

•

ROTARY PERCUSSION DRILLING, a Patent and Literature Summary, Emory N. Kemler, Summary Reports, P. O. Box 176, Spring Park, Minn. $8.

This booklet makes available to the research and drilling engineer abstracts of literature and reviews patents relating to rotary percussion drilling. Abstracts of approximately 100 patents including one drawing for most patents and one claim from each patent are included. The book contains a chronological patent index and an index by inventors and authors.

•

TAXATION OF OIL AND GAS INCOME, School Edition, Clark W. Breeding and A. Gordon Burton, Prentice-Hall, Inc., 70 Fifth Avenue, New York, 1954. $5.

This book presents principles in the field of income taxation that control transactions common to the oil and gas producer. Although the book is primarily concerned with operations of the industry in the U. S., one chapter is devoted to tax concepts applicable to practice in Canada. A few of the phases of the subject discussed in separate chapters are kinds of property interests, classification of conveyances for federal tax purposes, leasing or subleasing transactions, sales or exchanges, sharing arrangements, ownership and operation of oil and gas properties, geological and geophysical costs, intangible drilling and development costs, depletion, co-ownership versus partnership, and unitization agreements, to name a few.

•

SIGNIFICANCE OF PROPERTIES OF PETROLEUM PRODUCTS, Edited by George Sell, The Institute of Petroleum, 26 Portland Place, London, W.1. 7s 6d net.

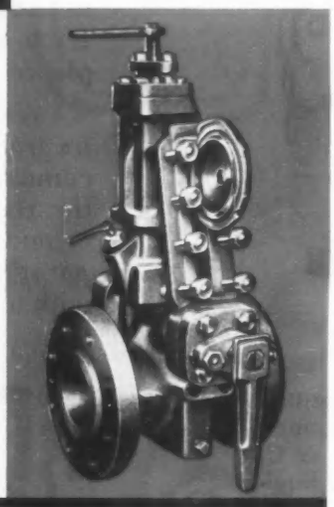
In an attempt to clarify the subject of the precise significance of the properties of petroleum products as determined by standard and other methods of test, the Institute of Petroleum published in 1949-1950 in the pages of the IP Review a series of 13 articles, each dealing with an individual property or a group of interrelated properties. Since then the various articles have been brought up-to-date by the authors, each of whom is an expert in his own field, and the series is available in this volume. It is believed that users of petroleum will benefit from such an account of the interpretation of the standard tests, while the student will find such information of great value.

ROBINSON OLDEST NAME IN ORIFICE FITTINGS

Type E For Low Pressure . . .

2" to 30" A.G.A. Spec.

Where, except at Robinson, can you obtain all these features in an orifice fitting for gas or liquid flow? Extreme accuracy of measurement is yours because the Robinson orifice is always centered with the piping and sealed against leakage. Orifice plates can be changed safely and quickly (3 to 5 minutes) with no interruption in flow, no hazards or gas loss. Various sizes and pressure ranges up to 3,500 PSI, flanged or welding neck.

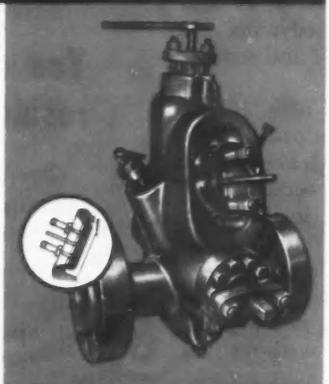


Type E For High Pressure . . .

2" to 6" Pipe Size A.G.A. Spec.

Same fine metering characteristics as the standard low pressure Type E shown above, but built for 6,000 PSI with positive pressure seal which becomes tighter as the pressure increases. Safety is assured because the fitting cannot be opened until the pressure is released. Available in flanged or welding neck. Compare Robinson point-by-point and you'll choose Robinson.

SEND FOR ROBINSON CATALOG NO. 54.



ROBINSON ORIFICE FITTING COMPANY

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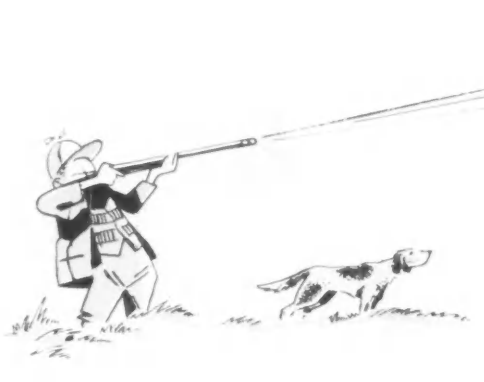

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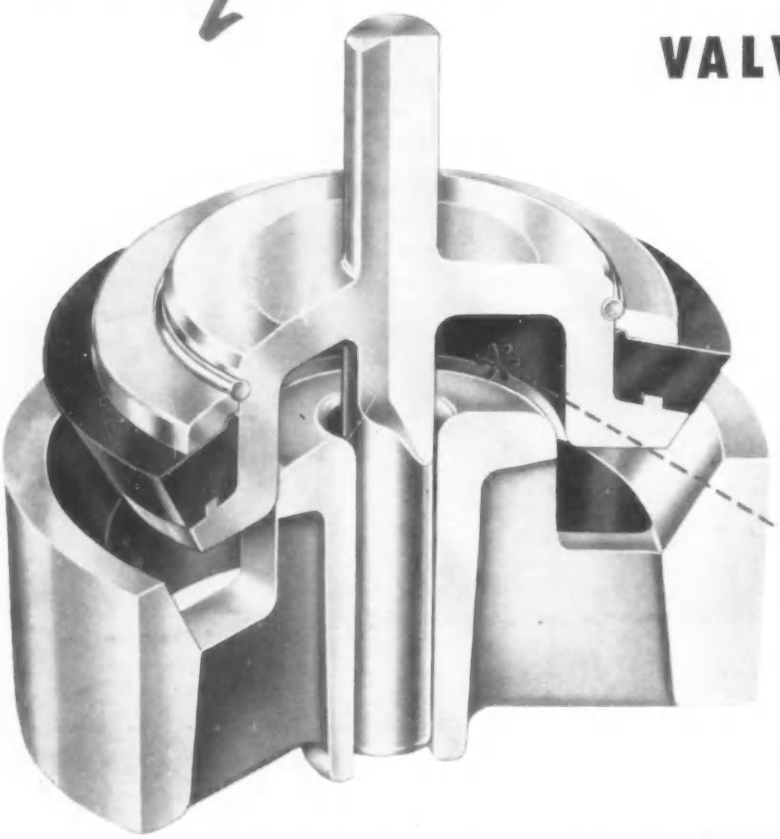

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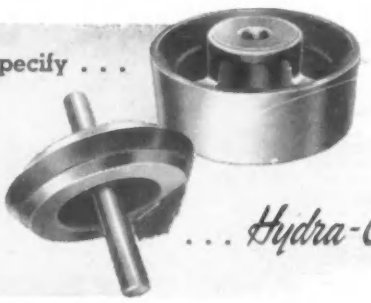

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